DISCOVERY

A MONTHLY POPULAR JOURNAL OF KNOWLEDGE

EDITED BY EDWARD LIVEING, B.A.

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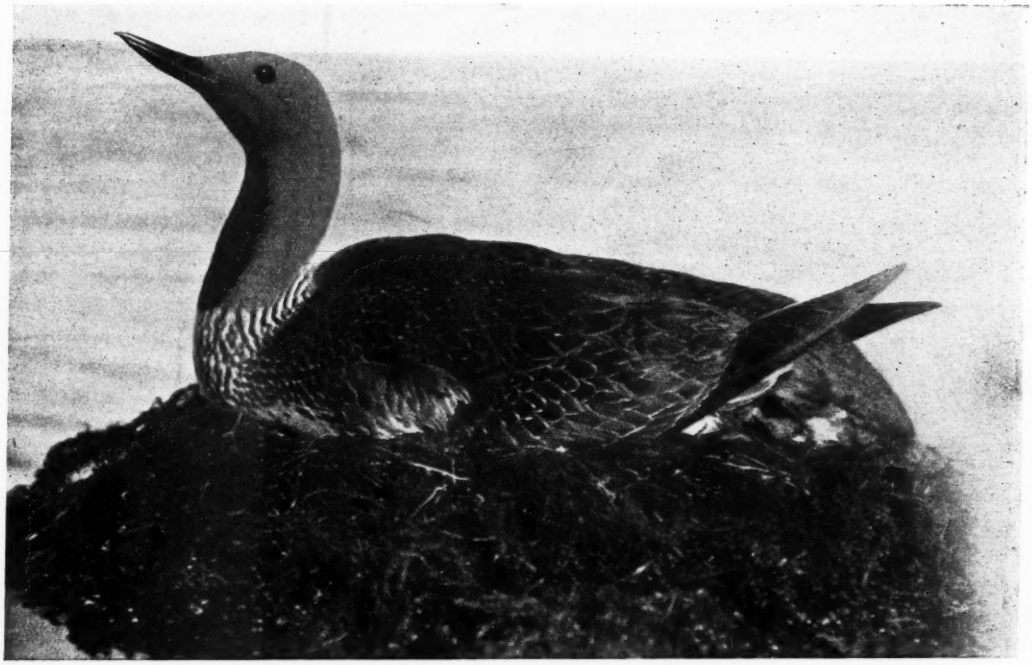

THE RED-THROATED DIVER ON ITS NEST

CONTENTS

	PAGE
EDITORIAL NOTES	29
DIRECTIONAL WIRELESS. Lt.-Col. C. G. Crawley	32
A NEW CHAPTER IN THE HISTORY OF EGYPTIAN ART. Dr. Aylward M. Blackman	35
OUR NEIGHBOUR WORLDS. The Rev. Hector Macpherson	40
THE COURTSHIP OF THE RED-THROATED DIVER. Julian S. Huxley	44
THE RENASCENCE OF THE ENGLISH SHORT STORY—I. Thomas Moult	48
MODERN WHALING. Dr. J. Travis Jenkins	50
THE TEACHING OF ENGLISH IN ENGLAND. A Note on the Government Report. Prof. Edith J. Morley	52
REVIEWS OF BOOKS	54
BOOKS RECEIVED	56

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DISCOVERY. A Monthly Popular Journal of Knowledge.

Edited by EDWARD LIVEING, B.A., Rothersthorpe, Northampton, to whom all Editorial Communications should be addressed. (Dr. A. S. Russell continues to act as Scientific Adviser.)

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Editorial Notes

THE presidential address delivered at the general meeting of the Classical Association held early in January was a fine summary of what both scholars and scientists have lately come to see more clearly than was the case not long ago, namely, that there is no essential antagonism between science and the classics, and that their combination in education is fruitful of the best results. We feel that Lord Milner expressed what is a steadily growing belief amongst our leading men of intellect when he said that "all modern science had its roots in the classics, and, on the other hand, no man imbued with the spirit of the great classical writers could be lacking in respect for science or fail to recognise its supreme importance to the progress of mankind." Another, and to our mind extremely important, point in Lord Milner's address—important because of its bearing on the present international problems—was his insistence on the vast share of Greece and Rome in the fabric of European civilisation.

* * * * *

With regard to Lord Milner's first point, this can be illustrated simply enough. We know, of course, that the Babylonians and Egyptians possessed rudimentary mathematical ideas, but it was the Greeks who after the early sixth century B.C., when Thales, the geometrist and astronomer, returned from Egypt, developed those ideas into a complex theoretical as well as practical science. Again, no modern student of Natural Science will deny his debt to Aristotle, and doctors recognise that the main origins of their art spring from the writings of Hippocrates, who lived in the fifth century B.C. These are merely a few obvious examples. For a full account by well-known scientific and scholastic experts of the extent of our debt to the early Greek "scientists," we refer our readers to a recently published book, *The Legacy of Greece*.[1] To appreciate the stupendous achievement of the Greeks, we need to take a bird's-eye view of the world's history. Man had existed on the earth for several million years before their appearance. He had existed, sometimes as in Egypt, with a certain degree of nebulous questioning as to his existence that resulted in fantastic religions; but on the whole, existence without too much questioning had been sufficient for him. Now the Greeks started to probe the problem of existence very thoroughly, and from what knowledge they possessed to formulate and test theories about the origin of life, the soul, the earth, the heavens, etc. In their resultant discussions and writings they laid the foundations of what we moderns call "science."

* * * * *

This questioning spirit of the Greeks laid not only the foundations of science, but of Western civilisation. Let us for the moment still keep our bird's-eye view. As Professor Gilbert Murray[2] has lately pointed out: "In the total age of the world or of man the two thousand odd years between us and Pericles do not count for much. . . . Yet in a sense the world was young then, at any rate our Western world, the world of progress and humanity. For the beginnings of nearly all the great things that progressive minds now care for were then being laid in Greece." That is just it. Our vaunted "civilisation," which has marked Europe and modern America from the

[1] Edited by R. W. Livingstone and published by the Clarendon Press, Oxford, 1921, 7*s*. 6*d*.

[2] In his introductory contribution to *The Legacy of Greece* on *The Value of Greece to the Future of the World*.

rest of the world, is little over 2,000 years old—2,000 years, a mere fraction of the several million years during which man has inhabited this earth. And it was started in a small peninsula broken up by mountains and sea into numerous little warfaring states.

* * * * *

But it is doubtful if the Greek spirit would ever have permeated Europe except for the powerful consolidation it received at the hands of Rome and of Christianity. Truth, Beauty, Freedom—above all the last in the fullest meaning of the word—these were the teachings of Greece. But "freedom, as we know it, is the fruit of the training of Western Europe for many centuries in Greek ideas, conveyed first through Roman channels. . . ." I take these words from a recent book by Professor Conway,[1] who has shown in the most enlightening manner the share of the Roman Empire in moulding Western civilisation, and in engrafting into it the idea of justice and free government. As Professor Conway points out in the final chapter in his book, it was mainly the Roman idea of municipal government that saved Europe from complete chaos in the Dark Ages, and was a potent influence in its subsequent rebirth.

* * * * *

We have intentionally concerned ourselves with the Græco-Roman elements in our civilisation, and with the debt that we owe to them. We acknowledge at once, without going further into the matter, the vast contribution of Christianity. Lord Milner said towards the end of his presidential address: "Among the factors which for many generations have made most powerfully for the maintenance of some measure of moral unity among European nations, Christianity and Græco-Roman culture stand out pre-eminent."

* * * * *

We are entering a new era of civilisation, in which the idea of internationalism is going to play a big part. There is a tendency amongst extremists to think that the elements of European civilisation, of which we have spoken, are outworn and are likely to be discarded in this new era. We believe that this is not the case. One of the most remarkable signs of the times is the way in which Oriental nations are co-operating with Western civilisation—in the League of Nations, at the Washington Conference, and elsewhere. To what end? Surely, on the whole, for justice, freedom and order as against slavery, treachery, and chaos. And these, taking the broader aspects of their history, are the very things for which our spiritual ancestors, the Greeks and Romans, fought and wrote and lived.

[1] *New Studies of a Great Inheritance.* (John Murray, 1921. 7*s.* 6*d.*)

The eyes of the world are at the present moment fixed scrutinisingly on Russia. We are constantly being told that Russia is an enigma, even to her own people, that no one can understand this people, since they do not understand even themselves. Yet, surely, the answer to the enigma is that Russia, while the rest of Europe was being impregnated by Roman colonisation, lay under the domination of the Mongols; that within her vast frontiers the ideals and races of the East and West have been in continuous conflict. Such at least is the answer to which any thinking person who has read the great Russian novelists, or listened to Russian music, or watched the Russian ballet, is instinctively driven. In the individual souls of these people, cruelty and kindness, uncontrolled passions and high ideals, energy and laziness, are always trying to get the upper hand of one another. Lately we have seen them break up a terrible régime of oppression only to replace it by one of far greater tyranny and cruelty.

* * * * *

But the fight that has been for many centuries, and is still being, waged at a far intenser pitch in Russia, is symptomatic of the fight that is going on all over the world. It is the fight of Western civilisation against slavery, treachery, and chaos. No one who has lived long amongst Oriental peoples will deny that they have much to teach the world, but no one better than he realises the value of the Westerner's attitude to life and humanity. As we have already remarked, we believe that the East on its side is beginning to appreciate many of the teachings of Western civilisation. This is not the juncture in the world's affairs for the people of Europe to discard in education or in aught else the bases themselves of that civilisation.

* * * * *

From time to time there appears in the daily Press a sensational claim that gold can be made by artificial means. No less than three of these claims were made last year, and altogether about a dozen have been put forward in widely different parts of the world during the past twenty years. There is a great similarity about these claims. The claim is always put forward by someone who is quite unknown in the scientific world, and it is a curious mixture of current scientific theories, of experiments that might conceivably be carried out, of a certain amount of palpable error and of a good deal of nonsense. For a short period each claim occupies a place in the conversation of educated persons; a few distinguished scientists are interviewed by the newspapers; a few economists and others express their opinions, but nothing ever happens and soon the subject drops.

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It may be said at once that this talk about making

"synthetic gold" is nonsense. It is not nonsense like the popular superstition that Hector Macdonald or Lord Kitchener is still alive, for there is no possibility that either of these men is alive, and there is a possibility that gold may some day be made from other materials. But it is nonsense because in fact no one has ever made gold artificially. Men who claim that they have done so have not done so. They have really done nothing but assert that a process, which the careful work of a few brilliant scientists has shown to be *possible*, is actually an accomplished fact. But there is a difference between a thing that is possible and a thing proved or done, and this difference may be very great.

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The two scientific ideas underlying the process of making gold artificially are these. First, there is evidence in nature, obtained partly from physics and partly from astronomy, that the heavier elements have been, and are being, built up in some way upon lighter ones; that the elements are not fundamentally different, as was thought thirty years ago, but are merely different aggregations of a very special kind. The second is that the discoveries in radio-activity (1899–1903) revealed the spontaneous transformation of certain heavy elements into lighter ones. Both of these are important and illuminating ideas. The first suggests that elements may be formed by synthesis, i.e. by building up from simpler forms; the second, by degradation or breaking down from more complex. But these are natural processes, and research into their nature has so recently been begun that we are not yet able to imitate them. How or why they occur is yet a mystery. We know little about them save that they exist.

* * * * *

Of the two processes, that of disintegration or breaking down would at first sight appear to be the more hopeful, for it is common experience that to smash to pieces a delicate mechanism is easier than to accomplish successfully the reverse process; and on pursuing the matter more deeply this view is found to be justified. The building up of elements, which is supposed to be going on in the Universe, cannot be properly studied in a laboratory; radio-activity can, and so it is that from this science alone the meagre existing evidence concerning transmutation has been obtained. Part of this evidence is negative, part positive. The negative evidence is that high temperatures and great pressures (by which, for example, carbon or graphite may be converted into diamonds), have no effect whatever in transforming one element into another; the positive is that certain of the lighter elements, when bombarded by atoms of helium, shot out at great speeds by preparations of radium, do break down into simpler forms, one of which is certainly the element hydrogen. The enormous difficulties which this process, the only known method of effecting artificial transmutation, involves, have already been mentioned in an article in this journal.[1] No more need be said here than two things: there appears to be little hope that the process can be so extended that common metals like bismuth, lead, or mercury will be transmuted by disintegration into weighable quantities of rarer metals like gold and platinum, and none that this will be effected on a commercial scale. Second, if a new process be found, or the present one be extended, it will be the work of someone who is "inside" this extremely technical piece of research work; it will not be accidentally found by an unknown man.

Contributors to this Number

Lieut.-Col. C. G. Crawley holds the position of Deputy-Inspector of Wireless Telegraphy in the General Post Office, and also that of Secretary of the Technical Commission which is planning the Imperial Chain of Wireless Stations. He entered the service of the Post Office in 1913 after ten years' employment in the Navy as Experimenter, Instructioner, and Fleet Wireless Officer. He returned to the Naval wireless service for the period of the war, when he served as a wireless officer in the Grand Fleet, at the Admiralty, in command of the R.N.V.R. wireless school, and supervised the erection and working of various naval stations abroad.

Dr. Aylward M. Blackman, after studying Oriental languages at Oxford with high honours, devoted himself to Egyptology. From 1906 to 1912 he was constantly employed on archæological expeditions in Nubia and Egypt, and, as the result of his researches, has made extensive contributions to the literature of his subject. In 1912 he took on the work of the Archæological Survey of the Egypt Exploration Society, in order to publish the very important Old and Middle Kingdom tomb-chapels at Meir, near Asyūt, on which he has so far produced three volumes. He resumed work on the site last year.

The Rev. Hector Macpherson had a most successful career at Edinburgh University, and at New College, Edinburgh, where he was Waterlock Prizeman and Cunningham Fellow. He has carried through extensive investigations on the distribution of the stars, and on the moon and planets. He is the author of articles in many scientific journals, and of several volumes, including *A Century's Progress in Astronomy*, *Through the Depths of Space*, and *Practical Astronomy*.

Mr. Julian Huxley gained a scholarship at Balliol College, Oxford, in 1906, first-class honours in National Science and the Naples scholarship in 1909, a "blue" for the high jump and the Newdigate Prize for English verse. He was appointed a Fellow of New College, and Senior Demonstrator in the Department of Comparative Anatomy, Oxford University, in 1919, and is the author of *The Individual in the Animal Kingdom*, and a well-known contributor to scientific and literary papers.

Thomas Moult is one of the most versatile of the younger English authors. *Snow over Elden*, his first novel, was published in 1920, *Down Here the Hawthorn* (poems) in 1921. He is the founder and editor of *Voices*, a magazine of the arts, now in its fourth year. He has contributed extensively to our leading literary journals.

Dr. J. Travis Jenkins was appointed Professor of Zoology at Hartley University College, Southampton, in 1903, and Superintendent of Fisheries for the Lancashire and Western Sea Fisheries Committee in 1904. He was called to the Bar in 1907. Thereafter he undertook official investigations of Indian fisheries, resuming his Lancashire appointment in 1911. He is the author of *Sea Fisheries*, a textbook of oceanography, and *A History of the Whale Fisheries*.

[1] Discovery, vol. ii, p. 200.

Directional Wireless

By Lieut.-Col. C. G. Crawley, R.M.A., M.I.E.E.

As a rule, at small wireless stations, such as those for communication with ships and those in the ships themselves, no attempt is made to obtain any directive effects, that is to say, the waves from the sending station are radiated in all directions, and at the receiving station waves can be received equally well from all directions.

For the ordinary purposes of communication between ships, and between ships and shore stations, it is indeed essential that all-round signalling should be the normal

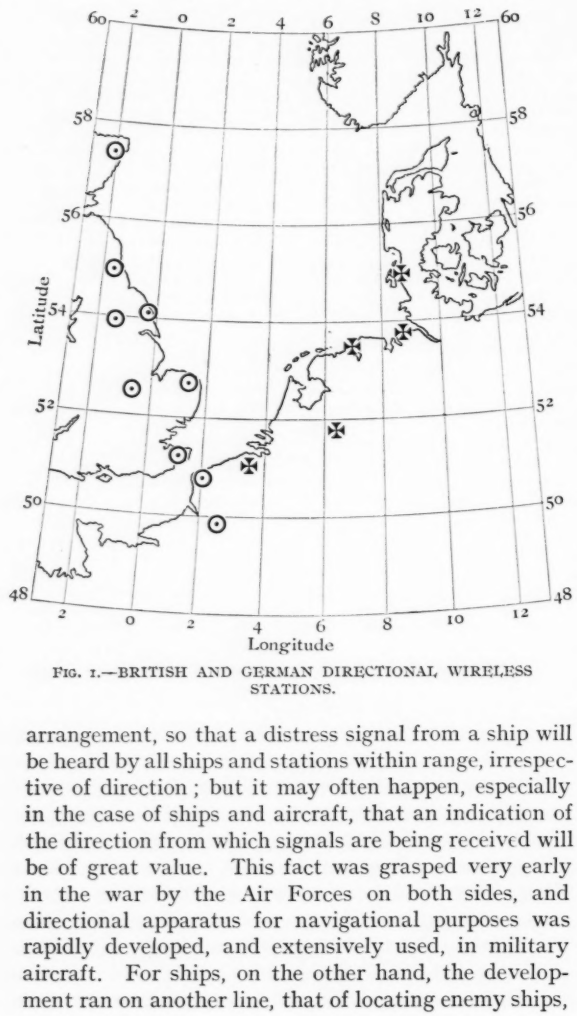


FIG. 1.—BRITISH AND GERMAN DIRECTIONAL WIRELESS STATIONS.

arrangement, so that a distress signal from a ship will be heard by all ships and stations within range, irrespective of direction; but it may often happen, especially in the case of ships and aircraft, that an indication of the direction from which signals are being received will be of great value. This fact was grasped very early in the war by the Air Forces on both sides, and directional apparatus for navigational purposes was rapidly developed, and extensively used, in military aircraft. For ships, on the other hand, the development ran on another line, that of locating enemy ships, which were using wireless, by means of direction-finding shore stations, and stations used for this purpose by both sides round the North Sea are shown in Fig. 1. These stations, at any rate those on our side, did excellent work in obtaining timely information on many occasions of the movements of enemy craft, both ships (including submarines) and aircraft. The most famous occasion was that leading up to the Battle of Jutland. This was well told at a meeting of the Institution of Electrical Engineers by Admiral of the Fleet Sir Henry Jackson in the following words: "We have heard much about the use of direction-finding for minor tactical movements of all arms, but this is a case of a major strategical operation which brought about the historical meeting of the British and German Fleets at the Battle of Jutland on May 31, 1916. I was First Sea Lord at the time, and so was responsible for the disposition of the Grand Fleet. I may incidentally mention that, in spite of other statements of which I have heard, its Commander-in-Chief (Lord Jellicoe) and I lived, so to speak, with the object of bringing off such a meeting. Our wireless direction-finding stations, under Captain Round, kept careful and very intelligent watch on the positions of German ships using wireless, and on May 30, 1916, heard an unusual amount of wireless signals from one of the enemy ships which they located at Wilhelmshaven. This was reported to me; the time was a critical and anxious one in the war, and I had also some reasons for expecting that the German Fleet might put out to sea during the week. Our Fleet was ready at short notice and had arranged, unless otherwise prevented, to put to sea on the following day for a sweep of the North Sea. But if the German Fleet got to sea first, the chance of a meeting in waters not unfavourable to us was remote; our object was to try to get to sea before or shortly after the Germans, and hitherto we had not succeeded in doing so. Later on in the afternoon, it was reported to me that the German ship conducting the wireless had changed her position a few miles to the northward. Evidently she and her consorts had left the basins at Wilhelmshaven and had taken up a position in the Jade River ready to put to sea. This movement decided me to send our Grand Fleet to sea, and move towards the German Bight at once and try to meet the German Fleet and bring it to action. This they did with their usual promptitude, and the result was the famous Battle of Jutland, and it was indirectly brought about by the careful and accurate work of Captain Round and his staff, for which I hope they will now accept my belated thanks and appreciation. Their work is not ended. Direction-finding has come to stay for more general use in peace. Errors are being eliminated, and there should be a great future before it, especially on the lines

indicated in the Press to-day by the Admiralty for assisting navigation at sea as well as in the air."

It will be gathered from Admiral Jackson's closing remarks that some of the war-time direction-finding stations are still being used; but for the more peaceful purpose of assisting in the navigation of ships and aircraft. The stations were not used for that purpose to any great extent in the war, though directional sets fitted on aircraft were used pretty frequently for navigational purposes by obtaining bearings from known fixed land stations.

At first sight, it would appear that directional receiving sets in ships or aircraft would be invaluable for obtaining bearings from land stations, and so they would be if the results obtained were always reliable. There are, however, errors which are liable to arise from various causes, some of which are not yet fully understood, and cannot therefore be allowed for. The most serious of these arise from bendings of the paths of the waves by reflection and refraction due to certain states of the atmosphere; for instance, observations may be made at, say, 100 miles, within an accuracy of 1 degree on nineteen days out of twenty, but on the twentieth day there may be an error of as much as, say, 5 degrees, due to some bending effect on the path of the waves taking place between the sending and receiving stations. There are also possibilities of local errors due to the effects of metal-work, such as stays for masts, etc., at the receiving station, as well as bending effects on the waves due to the proximity of cliffs, or long coast-lines in the path of the waves. These local errors, since their causes are better understood, can be eliminated, or corrected, sufficiently for all practical purposes, but it is clear that, at the best, the bearings given by wireless directional methods cannot yet be looked on as thoroughly reliable. The point is, however, that they are sufficiently reliable to be very useful when it is impossible to take observations by other means, due to, say, thick or foggy weather.

We might now examine briefly the principles underlying directional wireless, and in doing so let us first recall the usual non-directional arrangement. At the transmitting station, wireless waves are radiated in all directions by oscillatory electric currents flowing in an elevated system of wires, called the aerial or antenna, which in its simplest form, and that first used, consists of a single vertical wire. At the receiving station these waves produce similar, though much weaker, currents in the receiving aerial, which in its simplest form consists also of a single vertical wire, and there is no directional effect; that is to say, the direction from which the waves are coming has no effect on the strength of the signals received. As soon, however, as the aerial is bent or sloped out of the vertical, so does it become better for sending to, or for receiving from, one direction more than any other. This effect was foreshadowed in Hertz's original experiments in Germany in 1887, but was not made much practical use of until 1905, when Marconi commenced to use an inverted L-shaped aerial for transmission and reception. Such aerials transmit best to, and receive best from, the direction opposite to that towards which the horizontal portion stretches, but the effect is not very strongly marked. Aerials of this description are used at many high-power stations, so that the greatest possible radiation is directed towards the receiving stations.

Another form of directional aerial which is very extensively used, especially for receiving stations, consists of a vertical rectangular loop which best receives waves travelling in the direction of the base of the rectangle. Signals from any other direction are weaker, until in the line at right angles to the best direction no signals are heard.

This effect can be easily seen from a consideration of Fig. 2, where A and B are two vertical wires, and R

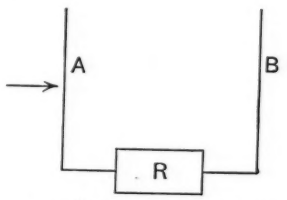


FIG. 2.—RECTANGULAR LOOP AERIAL.

is the receiving apparatus. If the waves are coming from the direction shown by the arrow, or in the exactly opposite direction, their effect on A will not be the same, at the same moment, as their effect on B, and some current will flow through the receiver. If, however, the waves are coming in a direction at right angles to this, i.e. through the paper, they do produce the same effects in A and B at the same moment, and no effect is produced in R. This is clear if one considers the moment when the waves produce currents of the same strength flowing down A and B simultaneously, as then, so far as R is concerned, these currents cancel one another and produce no effect. This arrangement of directional aerials was first introduced by S. G. Brown in this country in 1899. The Italians, Bellini and Tosi, used triangular loop aerials, as in Fig. 3, at right angles to one another, in conjunction with a special receiving circuit, in which a coil is revolved by hand until signals become loudest, when a pointer attached to the coil indicates on a scale the direction from which the signals are being received. As a matter of fact, greater accuracy is obtained by noting when the coil is in the position

where signals become inaudible, or by introducing another coil into the circuit and noting when its introduction has no effect on the strength of signals, but these are technical details which need not be considered here. This Bellini-Tosi arrangement was used for several years before the war, but was not fully developed until, during the war, the introduction of the three-electrode thermionic tube as an amplifier of weak signals completely revolutionised wireless reception, and made it possible to employ small loop aerials for the reception of signals transmitted from even great distances. Small loops are now extensively used for direction-finding purposes in aircraft, and larger ones in ships. The adoption of this apparatus in ships is not so general as in aircraft, but a few score of our merchant ships are already fitted. The possible errors already mentioned largely account for this comparatively slow growth, as well as the fact that directional shore stations can give more accurate

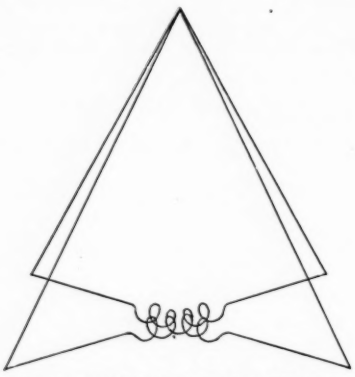


FIG. 3.—TRIANGULAR LOOP AERIALS.

bearings to ships than ships can obtain with their own directional apparatus.

In France, nine of these shore stations are already in operation along the English Channel alone, and in the United States about a hundred are contemplated, of which more than half are working. In this country there are only four in operation. These are at present under Admiralty control, but as has recently been announced in the Press, it is intended to transfer this work to the Post Office, the department responsible for our commercial wireless communications. In shore stations greater accuracy is obtained than in ships, as there are less obstructions to the path of the waves in the form of masts, stays, etc., and more highly trained operators, as well as conveniences in the matter of space, quietness, and stability, are available.

A ship or aircraft fitted with directional apparatus can obtain a bearing relative to its fore and aft line from any wireless station which it hears transmitting, and by taking such bearings from two, or preferably three, stations, it can obtain its position, usually to a degree of accuracy sufficient for the purposes of navigation when other means have failed, provided that the stations happen to be suitably placed for obtaining a good cut with the lines of bearing. For distances up to about 100 miles the bearings can be plotted on the usual Mercator's chart, but for greater distances a chart on the gnomonic projection must be used. In these gnomonic charts, great circles appear as straight lines instead of curves as in Mercator charts, and the necessity of using the gnomonic projection for long ranges is evident when it is remembered that wireless waves travel along great circles over the surface of the earth. As a matter of fact, in ship work, bearings from stations at distances of over 100 miles are very seldom required, so that the usual Mercator chart gives sufficiently accurate results under favourable conditions; but, as mentioned above, the results obtained by ship sets are not so reliable as those obtained by direction-finding shore stations. In the latter case, the ship, which does not require any directional set of its own, calls up a station and asks for its bearing. The ship then transmits a succession of letters, the station takes the bearing and signals it to the ship. Sometimes two or more stations work in conjunction; each takes a bearing, and the controlling station then signals to the ship the position which is obtained from the bearings taken. It will be noticed that when shore stations do the work, the responsibility for the results rests with them, not with the ship, as would be a more satisfactory arrangement if the results obtained by ships were as reliable as those obtained by shore stations. In this country, a charge of five shillings is made for a bearing given by a direction-finding shore station, and similar charges are in contemplation, or are already made, in several other countries.

The "radiophare," or wireless lighthouse, is another form of directional shore station, and some of these are in operation in France and the United States, but not in this country. A radiophare is a directional transmitting station which sends out continuously a beam of wireless waves in a certain direction, strong enough to be received by a ship up to a range of, say, thirty miles. The transmission consists of the call signal of the station sent continuously, so that when a ship is receiving this signal it knows that it must be somewhere in the beam sent out by that particular station, and details are published of the direction of the beam sent out by each radiophare. This form of station is being found useful for navigational purposes during fog in narrow waters, such as river mouths and channels.

Directional receiving stations are now coming into extensive use for another quite different purpose, viz. commercial long-range point-to-point communication. Three conditions are required for a paying commercial long-range service; first, high-speed signalling; secondly, duplex working; thirdly, freedom from interference, and of these the second and third can be obtained, to a great extent, by receiving the messages at a directional receiving station separated from its sending station. This arrangement is now made for practically all long-range services throughout the world. In duplex working, messages are sent and received at the same time, the receiving station being some miles distant from its sending station, and arranged directively, so that it can receive from the distant station without being interfered with by the transmission of telegrams from its own sending station. Similarly, freedom from interference from other stations is materially assisted by the fact that the receiving station, being directional, can only receive well on the line, or prolongation of the line, between it and the distant station from which it wishes to receive, so that sending stations situated in other directions will not interfere. Owing to the great amplification in the strength of the current at receiving stations made possible by the use of thermionic tubes, quite small loops consisting of a number of turns of wire wound on rectangular frames, about eight feet square, are now the only aerials used at many of the high-power stations in Europe for receiving commercial messages from stations at great distances such as those in the United States of America.

A New Chapter in the History of Egyptian Art

By Aylward M. Blackman, D.Litt.

ABOUT 200 miles south of Cairo on the west bank of the Nile in the province of Asyūṭ lies the town of Ḳuṣīyeh, the Cusæ of antiquity. Once the capital of the fourteenth nome or province of Upper Egypt, it has, in the course of centuries, dwindled into a place of small dimensions and third-rate importance. In the western desert, distant about a two and a half hours' ride from Ḳuṣīyeh, is to be found the ancient necropolis of that erstwhile famous city. It consists of an extensive chain of cemeteries, occupying not only a considerable stretch of the inner or western side of the lower desert, but climbing half-way up the steep limestone slope which terminates in the high desert plateau—the great and mysterious Sahara. To the whole of this ancient site the not far distant village of Meir has given its name.

The poorer inhabitants of Cusæ, like the local *felläḥīn* (peasants) of to-day,[1] buried their dead in the lower desert. The high desert slope is honeycombed with the burial-pits of the wealthier citizens, and here also are excavated the tomb-chapels of the great feudal lords or nomarchs of Cusæ, who flourished from about 2920 to 1900 B.C.[2] It is with the reliefs and paintings decorating the walls of some of these chapels that the present article is concerned.

Not till well on in the Fifth Dynasty, about 3050 B.C., when, owing to the weakening of the centralising power of the Memphite or Old Kingdom Pharaohs, the feudal system had pretty fully developed, did the provincial governors start to construct their funerary chapels near their respective seats of government. Hitherto they had been so closely attached to the court and person of the sovereign, to whom they owed their positions, that they had always been buried near his pyramid, which was regularly erected in the neighbourhood of the capital. By the beginning of the Sixth Dynasty, about 2920 B.C., these governors, who in the first instance had been appointed by the king and exercised their religious and civil functions solely as his representatives, had become feudal barons, each firmly entrenched in his own domain and ruling over it by right of inheritance—though to be sure, when a son succeeded his father, the succession had anyhow in theory to be ratified by the Pharaoh. To this last-named period, the Sixth Dynasty (*circa* 2920 to 2720 B.C.), must be assigned the earliest sculptured and painted tomb-chapels of the Cusite nomarchs at Meir, for the decoration of which the local craftsmen employed the same subjects, and rendered them in the same manner, as the court artists at Memphis who adorned the royal funerary temples and the tomb-chapels of the nobles, still to be seen at Saḳḳāreh, Gīzeh, and Meidūm. Both the subjects and the manner of rendering them had been stereotyped for centuries, and the same scenes and groups of figures were reproduced over and over again by the Old Kingdom craftsmen with very little variety. The only difference between the work of the court and provincial artists is that the latter did not make use of such a variety of subjects as the former, while their workmanship is decidedly rougher and clumsier.

After the fall of the Sixth Dynasty the feudal lords seem to have contented themselves with undecorated tomb-chapels; anyhow, none of Old Kingdom date at

[1] See W. S. Blackman, "Some Modern Egyptian Graveside Ceremonies," in DISCOVERY, vol. ii, pp. 207 foll.

[2] In accordance with the revised dating of Dr. Ludwig Borchardt in his work, *Die Annalen und die Zeitliche Festlegung des alten Reiches der ägyptischen Geschichte*, Berlin, 1917.

Meir can be assigned to a time later than the end of the reign of Piōpi II, about 2720 B.C. From then onwards until the Eleventh Dynasty, about 2040 B.C., with which began the Middle Kingdom, the scenes, hitherto represented in reliefs or frescoes on the walls of the funerary chapels, were reproduced in the form of wooden models—some of them being of beautiful workmanship—which were placed along with the mummy in the subterranean burial-chamber.

With the advent of the Twelfth, or perhaps rather towards the end of the Eleventh, Dynasty, the Cusite barons again began to have their tomb-chapels adorned with painted reliefs, these reliefs being of a very remarkable character. In the interval between the Sixth and Eleventh to Twelfth Dynasties a new and local school of art seems to have grown up at Cusæ. The artists who executed the reliefs in the earlier Middle Kingdom tomb-chapels at Meir, those of Senbi and his son Ukhḥotpe, had broken away to a very great extent from the artistic traditions and conventions of the Old Kingdom or Memphite school, and had developed a style of their own which is characterised by its remarkable freedom, especially in the treatment of the human form.

It is not in the choice of subjects, but in the rendering of them, that the early Middle Kingdom art of Cusæ differs from the traditional art of Memphis. The Cusite artists, indeed, still employed the same stock scenes as are to be found on the walls of the *maṣṭabehs*[1] of Saḳḳāreh and Gīzeh, but they imbued them with a new vigour and carried them out with a freedom hitherto unknown. This break with old-established conventions, be it noted, is as a rule observable in the figures of persons of little social importance, such as herdsmen, fishermen, and the like, and in the representations of animals, not in the figures of the owner of the tomb-chapel or of his wife or yet of officiants engaged in performing strictly liturgical acts, all such being executed in the old traditional manner.

It is possible that this naturalistic art originated not among the craftsmen of Cusæ, but of Heracleopolis Magna, now called Ehnāsiyeh el-Medīneh, the seat of the central government during the Ninth and Tenth Dynasties, which lasted from about 2500 to 2220 B.C. Anyhow, it was certainly in that city that some of the finest literary works of ancient Egypt were produced, viz. the so-called *Eloquent Peasant*, *The Instruction which King Akhthoi made for his Son Merikerē'*, *The Admonitions of an Egyptian Sage*, and possibly also *The Dialogue with his Soul of One who is Weary of Life* —works of striking originality and of marked freedom in thought and style.

The new and free spirit which inspired the early Middle Kingdom artists of Cusæ makes itself strongly felt in a hunting scene in the tomb-chapel of Senbi (Fig. 1). In the choice and general arrangement of the various figures of animals it closely resembles other Egyptian hunting scenes, in particular that which once decorated one of the walls of the pyramid-temple of the Pharaoh Saḥurē' (Fifth Dynasty), and which is now preserved in the great Egyptian collection of the Berlin Museum. The Memphite sculptors of reliefs were distinctly more successful in depicting animals than in rendering the human form, and the animals in the last-mentioned scene give one a vivid impression of life and motion. But even in this respect the sculptors of Memphis have been surpassed by those of Cusæ. Neither in the Sahurē' hunting relief, nor in the similar reliefs occurring in the Old Kingdom *maṣṭabehs* at Saḳḳāreh, Gīzeh, and Meidūm (see e.g. that in the *maṣṭabeh* of Ptaḥḥotpe[2]), is there anything quite as

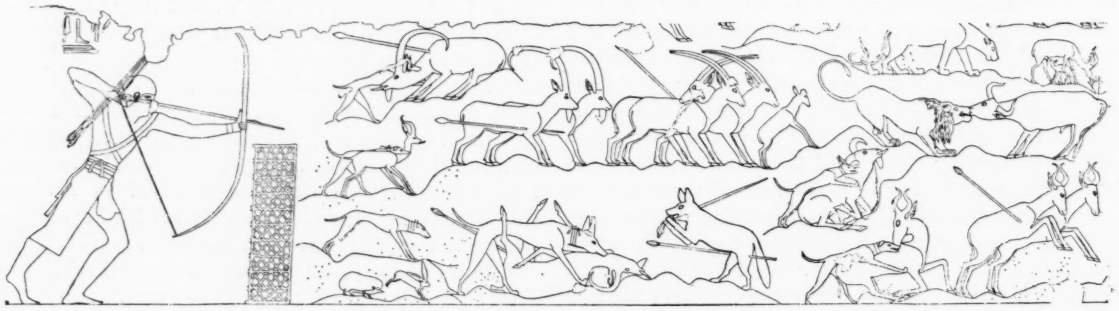


FIG. 1.—HUNTING SCENE IN SENBI'S TOMB-CHAPEL.

[1] The tomb-chapels of the Old Kingdom nobles are so designated because in shape—they are rectangular flat-topped masses of masonry with sloping sides—they closely resemble the stone bench, *maṣṭabeh*, upon which the customers sit outside the open Arab shop. For an excellent representation of a group of *maṣṭabeh*-tombs see A. Erman, *Life in Ancient Egypt*, English translation by H. M. Tirard, London, 1894, p. 311.

[2] The *maṣṭabeh* or tomb-chapel of Ptaḥḥotpe, a high official of the Fifth Dynasty, contains some of the finest reliefs executed by the Old Kingdom Memphite sculptors (see J. E. Quibell, *The Ramesseum*, London, 1896 [out of print], and N. de G. Davies, *The Mastaba of Ptahhetep and Akhethetep at Saqqareh*, 2 parts, London, 1900–1901).

vigorous as the Cusite sculptor's representation of the lion's tussle with the bull. The lion has caught the bull by the muzzle, and they both pull one against the other for all they are worth! It is a fine piece of realism, for a lion, when he attacks a bull, always *does* make for this part of him, so a big-game hunter tells me, it being the poor beast's most sensitive spot, and, when once he is grabbed there he is practically powerless. How full of life, too, are the fleeing hartebeests, antelopes, and gazelles, and the hounds who grapple with them and bring them down! And surely it was the artist's deliberate intention to emphasise the difference between the slow gait of the hedgehog and the rapid flight of the hare when he placed them in such close proximity.

But the outstanding feature of the relief is the figure of the noble hunter himself. Every muscle is tense, and every nerve alert as he raises himself on the toes of his right foot and leans forward to discharge an arrow from his bow at the flying deer—the keen sportsman every inch of him. In no other ancient Egyptian hunting scene preserved to us is there to be found so lifelike or so vigorously posed a bowman.

The artist's break with tradition is all the more remarkable in that it is the figure of the owner of the tomb-chapel himself which has been treated in this way, a very unusual occurrence even at Meir. The only other instance in these tomb-chapels of such an unconventional rendering of the figure of an important personage is to be found in a relief in the adjacent tomb-chapel of Senbi's son Ukhḥotpe. That noble and his wife are there depicted being entertained by a party of musicians. He sits on a chair while she, squatting on the floor and lovingly clasping his leg, turns her face round and looks up with a smile into his face to see how he is being affected by the music and the no doubt highly emotional songs!

Other admirable examples of the naturalism of the Cusite artists occur in the tomb-chapel of Senbi,[1] for instance, the spirited representation of a bull being lassoed, a Bishāri herdsman with his oxen (cf. the very similar figure discussed below), and a fat old fisherman, who has just hoisted his heavily laden net out of the water.

Certain sculptures in the tomb-chapel of Senbi's son Ukhḥotpe are, so it is said by competent critics, to be reckoned among the greatest works of art that have survived to us from the ancient world. Take, for example, the old fellow leaning on a stick and conversing with a boatwright (Fig. 2). Pot-bellied, somewhat decrepit, and very garrulous, he is the type of old peasant that you may see any day in a modern Egyptian village. In the figures of the boatwrights, who continue their task quite regardless of the old man's idle chatter, the sculptor has produced a very lively bit of work. They really do seem to be tugging hard as they rope together the papyrus reeds out of which they are constructing a skiff.

FIG. 3.—TWO PAPYRUS-HARVESTERS.

FIG. 2.—OLD MAN CONVERSING WITH A BOATWRIGHT.

Almost as great an achievement as the fat old gossip are the two *fellāḥīn* who are binding a great bundle of papyrus reeds, which have just been harvested (Fig. 3). Particularly fine is the right-hand figure, whose hard muscles rippling beneath his soft skin are splendidly indicated, and who, it will be noted, is depicted in proper profile. He is the typical hulking Upper Egyptian yokel, the standing joke of the "urbane" town-bred clerk who haunts the coffee-house. Rather coarse-featured though he be, he is a good-natured

[1] Reproductions of these will be found in *Rock Tombs of Meir*, vol. i, pls. iii, x, xi, xxi, xxv, xxviii and xxx. Vide Bibliography at end of article.

fellow, always responding to a joke and always ready to take on any job demanding the exercise of physical strength, for that he possesses in abundance, and is only too proud and pleased to display it.

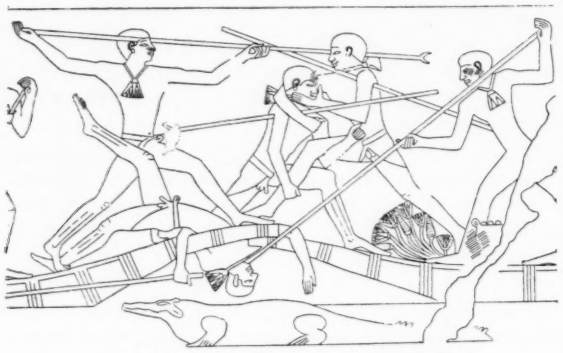


FIG. 4.—FIGHT BETWEEN TWO BOAT-CREWS.

The famous Italian sculptor Zanelli waxed enthusiastic over the Meir reliefs, and in particular, I think, over that depicting the fight between two boat-crews (Fig. 4). He delightedly drew my attention to the man who has fallen down, and whom one of the crew of the rival boat is jabbing in the throat with a punt-pole. The artist, Zanelli pointed out, has most brilliantly caught off the poor fellow's attitude at the very moment after he had tumbled into that unenviable position, for the muscles and sinews of the right leg and foot are still strained in the vain effort to recover the lost balance.

But perhaps the most outstanding example of the realism of the Cusite artists is the representation of the Bishāri herdsman (Fig. 5). He is leading along three oxen and for a staff holds the branch of a tree off which the twigs have been roughly lopped. About his loins hangs what looks like a piece of gazelle's skin, his sole garment. The body is shown in actual profile, not turned round full-face upon profile legs. He is the typical Hamite, and the sculptor has most cleverly reproduced all the facial and bodily characteristics of an old man of that race—a long nose, scanty tuft-beard and almost hairless upper lip, a scraggy neck, bony chest and shoulders and sinewy arms and legs. His head is crowned with a mass of tangled hair, in which respect he presents a marked contrast to the Egyptian, whose head was clean shaven or else closely cropped. That what has been said about the realism of the Cusite artists is not an exaggeration is clearly shown by a comparison of this relief with the adjacent photograph of a painting of a modern Bishāri (Fig. 6), made by my friend, Mr. F. F. Ogilvie, at Aswān, in 1914. This Bishāri of Aswān might be our old friend at Meir come to life again, the chief difference being that the one wears a little more clothing than the other. But all the physical peculiarities, also the very stick that each carries, are similar! Taken together the ancient relief and modern painting wonderfully illustrate how racial characteristics survive unchanged through the ages.

Ukhḥotpe was succeeded first by a noble of the same name, possibly his nephew, and then by his son Senbi, both of whom, it would appear, administered the affairs of the province for a very short time. The son's tomb-chapel was never completed, and the scanty decoration both of it and of the insignificant chapel of his immediate predecessor is in the ordinary conventional style of the period.

The next nomarch, another Ukhḥotpe, had excavated for himself a large tomb-chapel decorated with brilliantly coloured, for the most part plaster, reliefs. These are of the finest possible technique, the smallest details being inserted with infinite care by paint-brush or engraver's point. However, they display none of the naturalism which characterises the work of the early Twelfth Dynasty craftsmen of Cusæ, and they are executed in accordance with the ordinary canons of the official art, closely resembling the painted reliefs which are to be seen in the tomb-chapels of the lords of the Hare-nome[1] at El-Bersheh. On the lintel of one of the doorways in this Ukhḥotpe's tomb-chapel are inscribed the cartouches of Amenemmes II, the third king of the Twelfth Dynasty, who reigned about 1935–1903 B.C. This occurrence of the royal names—no cartouches are to be seen in any other Twelfth Dynasty tomb-chapel at Meir—and the fact, as certain of his titles show, that the nomarch in question was the

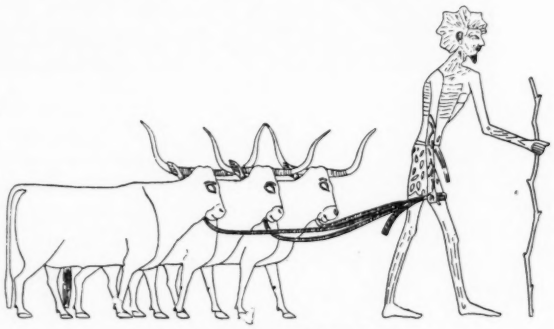


FIG. 5.—BISHĀRI HERDSMAN.

[1] I.e. the fifteenth nome of Upper Egypt. Every nome or province had its distinguishing heraldic emblem or badge, mounted upon a pole and thus carried as a standard. These emblems consist as a rule of some animal or plant, occasionally of some inanimate object or objects such as weapons of war. They probably represent the original local fetish or divinity of the primitive inhabitants of each of these districts, subsequently supplanted by a later intrusive divinity, the nome-divinity of historic times.

keeper of the pharaonic[1] diadems, indicate that he was more closely associated with, and perhaps more subservient to, the king than the previous Cusite barons of this period. The style of the reliefs in his tomb-chapel certainly suggests the influence of the court; indeed it is quite possible that they are actually the work of court artists.

The next and latest of the decorated Middle Kingdom tomb-chapels at Meir, that of yet a fourth Ukhḥotpe—son of Ukhḥotpe and Ḥeni the Middle—probably dates from the reign of Amenemmes II's successor, Sesostris II, under whom the power and magnificence of the feudal barons reached their culminating point. The influence of the court, so noticeable in the tomb-chapel of his predecessor, is conspicuously wanting in that of Ukhḥotpe IV. Everywhere are indications that local artists were employed, but artists whose style is completely different from that of the men who worked for the earlier Twelfth Dynasty barons of Cusæ. In the first place, coloured reliefs have been replaced by paintings *in tempera*. Secondly, instead of the naturalism and at the same time simplicity of the older Cusite art, we are confronted with a flamboyancy[2] combined with a display of affectation and mannerisms hitherto unknown in Egyptian art

FIG. 6.—A MODERN BISHĀRI FROM ASWĀN.
(*Photograph of a painting by F. F. Ogilvie in the possession of the author.*)

of any period. "Precious" is the adjective that best describes these certainly very attractive, if somewhat decadent, frescoes, which well reflect the luxury and fastidious tastes of the governing classes of that time.

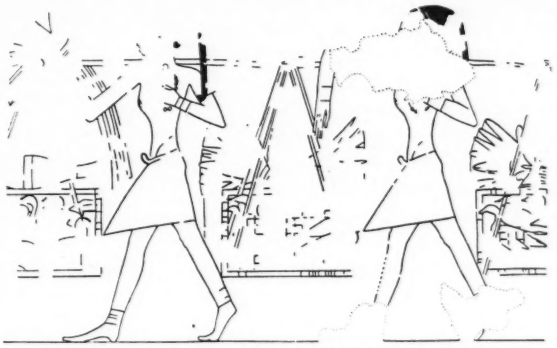


FIG. 7.—THIN-WAISTED YOUNG MEN CARRYING OFFERINGS.

The affectation and mannerisms in question are very conspicuous in the pair of young men, unhappily much defaced, shown in the adjacent cut (Fig. 7). They wear finikin bead necklaces quite unlike the ordinary Egyptian man's broad bead-collar, and, what is a most unusual feature, each has a long pigtail, with a curl at the end, hanging from the back of his head. They are painted pale yellow like the women, not the wholesome reddish brown of the ordinary Egyptian man; and, be it observed, *all* the men in these particular frescoes, farm-hands, fishermen, and agricultural labourers, are given this same effeminate colouring. In addition they all present the same physical peculiarities that are noticeable in the accompanying illustration—full developed breasts, thin waists, and rather broad hips. There is but one exception to this rule, the owner of the tomb-chapel himself, who is rather a burly fellow of the normal Egyptian build and with the ordinary dark complexion.

Is it a mere coincidence that all the chief monuments testifying to another and much later naturalistic movement in Egyptian art, a movement characterised by its disregard for accepted traditions, and by its unconventionalism, are to be found in this neighbourhood, namely, at El-Amarna, which is not twenty miles north of Cusæ? Outstanding features of the El-Amarna reliefs[3] and paintings are the broad hips, slender waists, and full-developed breasts of the men, which, it has always been maintained, were peculiarities of King Akhenaton's own person, and were, out of respect for him, assigned by the court artists to all his nobles and attendants in their representations of them. Now, as we have seen, very similar peculiarities in the rendering of the male form are to be observed in the frescoes adorning what I have pointed out is the latest of the decorated Twelfth Dynasty tomb-chapels

[1] The royal diadems, the White Crown of Upper, and the Red Crown of Lower, Egypt, were very sacred objects. Indeed, they were regarded as divinities, the embodiments of Nekhbet and Uto, who were the tutelary goddesses of Upper and Lower Egypt respectively. Hence he to whose custody these crowns were committed was not merely their keeper, but also their priest.

[2] Particularly in certain fishing and fowling scenes.

[3] For an account of the art and religion of El-Amarna see Professor Peet's article in DISCOVERY, vol. ii, pp. 252 foll.

at Meir. I would, therefore, make bold to suggest that the "new" art which we have been accustomed to consider a special development of the reign of Akhenaton, resulting from a change in religious beliefs and a consequent abandonment of old conventions, is really due to the fact that when the "heretic king" transferred the capital from Thebes to El-Amarna, the local artists were employed to decorate both the temples of the Aton and the palaces, houses, and tomb-chapels, of himself and his courtiers. If this suggestion is correct, then what we have always been taught to regard as a most notable example of realism in the art of El-Amarna, namely, the odd-looking figures of the king and his entourage, is, far from being realism, a gross affectation, inherited by the late Eighteenth Dynasty craftsmen of Cusæ from their Middle Kingdom predecessors and further developed and exaggerated during the intervening period.

BIBLIOGRAPHY

Breasted, J. H.: *A History of Egypt*, chs. vii–x. (New York, 1910. Price 30*s.*)

Blackman, A. M.: *The Rock Tombs of Meir*, vols. i–iii. (Published by the Egypt Exploration Society, London, 1914–1915. Price 25*s.* per vol.)

Davies, N. de G.: *The Rock Tombs of El-Amarna*, six vols. (Published by the Egypt Exploration Society, London, 1903–1908. Price 24*s.* per vol.)

Klebs, Luise: "Die Reliefs des alten Reiches" (esp. pp. 38 and 68 foll.), in *Abhandlungen der Heidelberger Akademie des Wissenschaften*. (London, 1915.)

Borchardt, L.: *Das Grabdenkmal des Königs Saḥu-rē'*, Band II: Die Wandbilder (esp. pl. 17). (Leipzig, 1913.)

Petrie, W. M. Flinders: *Tell-el-Amarna*. (London, 1894. Price 21*s.*, out of print.)

For good examples of the wooden models placed in the tomb with the mummy and replacing the wall-decorations, see:

Garstang, J.: *The Burial Customs of Ancient Egypt*. (London, 1907.)

Maspero, G.: *Art in Egypt*, pp. 88–91. (London, 1912. Price 6*s.*)

Our Neighbour Worlds

By the Rev. Hector Macpherson, M.A., F.R.A.S., F.R.S.E.

I. THE DWARF PLANETS

THE Solar System, over which the vast mass of the Sun exercises dominating authority, is composed of bodies of two types—firstly, the planets, which are solid globes of varying volume, mass, and density, which may be called more or less permanent and completed worlds, and which are themselves, with two exceptions, centres of subordinate systems of moons or satellites; and, secondly, the surplus matter which has been left over in the process of planetary evolution, and which exists in the form of comets, meteors, and asteroids. It is true that it has been customary to group the asteroids with the planets, for they have many planetary characteristics, but the discovery in recent years of innumerable small asteroids, some of them only a few miles in diameter, has shown that there is no hard-and-fast dividing line between these bodies and isolated meteors and the clusters of meteors which we call comets.[1] It would seem then that, so far as we know at present, there are only eight bodies in the Solar System which may be correctly designated as planets.

The planets fall into two main groups—the inner and the outer planets. They may be as accurately designated as dwarf and giant planets. Recent research has familiarised us with the division of the stars into the two groups of giants and dwarfs, and this separation into two types is plainly evident among the planetary bodies composing the Solar System. The giants—Jupiter, Saturn, Uranus, and Neptune—are large diffuse bodies, of great volume and low density, possessing apparently considerable internal heat; while the dwarfs—the Earth, Venus, Mars, and Mercury—are comparatively small worlds, of considerable density, and with cool, solid surfaces.

Planetary astronomy—the study of the surface-features and physical characteristics of the planets and their satellites—has not been characterised by the startling progress which has marked the development of stellar astronomy in recent years. In the study of the planets, the telescope, unaided by spectroscope or camera, still holds the chief place. In the investigation of the atmospheric envelope of the giant planets, it is true, photography is of some service and the spectroscope is a useful adjunct, but even here visual observation is of the greatest value. And in the case of the dwarfs, where the main object of the observer is the detection and delineation of minute surface detail, the spectroscope and camera play a very subsidiary part.

MARS

Of the three dwarf planets, which along with our own Earth form the group, Mars has been the most persistently studied, and as a result we are more familiar with its surface than with that of any other body in the universe, except the Moon.[2] For we on the Earth are in a peculiarly favourable position for the observation of Mars; when the planet approaches the Earth most closely, it is in opposition[3] to the Sun and its disc is

[1] The affinity of asteroids to comets was pointed out by Sir William Herschel as long ago as 1802.

[2] In a sense, indeed, we know Mars better than the Moon, as one lunar hemisphere is permanently concealed from our view (since the Moon always keeps the same face turned towards the Earth).

[3] A planet is in "opposition" when it rises at sunset, culminates at midnight, and sets at sunrise.

fully illuminated, and thus observation of its surface can be prosecuted for weeks and even months at a stretch. At favourable oppositions Mars is only 34 to 40 million miles away—which is, cosmically speaking, a trifling distance—yet the Martian disc never appears so large as that of Jupiter. It is much nearer to us, but its diameter is only about 4,200 miles—a little more than half that of our own world. And in small telescopes the disc is disappointingly small. Thus the progress of Martian astronomy was at first slow.

Before 1777, two facts alone had been ascertained. In 1638 Fontana, of Naples, caught glimpses of dusky markings on the little red disc, and his observations were abundantly confirmed by Huyghens in 1659, while in turn the Dutch astronomer's surmise that the Martian day was not dissimilar to our own in length was verified in 1666 by the elder Cassini, whose determination of the period as 24 hours 40 minutes was a remarkable approximation to the truth at that early stage of telescopic astronomy. In 1719, Maraldi, the nephew of Cassini, detected at the poles of the planet the two brilliant white spots which have since been known as the polar caps. The systematic study of Mars may be said to date from Herschel's significant discovery of the variation in size of these polar spots in accordance with the seasons. "I may well be permitted to surmise," Herschel wrote in 1784, "that the bright polar spots are owing to the vivid reflection of light from frozen regions; and that the reduction of these spots is to be ascribed to their being exposed to the Sun."

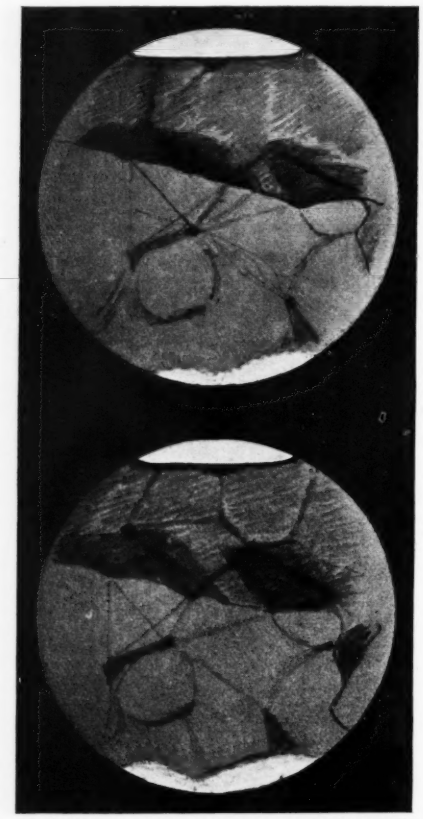
Herschel's study of Mars was only a part of his wider investigation of the structure of the Universe; and accordingly he made no systematic series of drawings, nor did he attempt to chart the planet. This was reserved for the famous German astronomer Mädler and his wealthy pupil Beer, whose survey of the planet occupied them for nine years, from 1830 to 1839. The telescope employed by Beer and Mädler was a comparatively small one—only four inches in aperture—and only the larger surface-markings were charted by them. But their work was continued during the middle decades of the nineteenth century by a number of observers of great skill and patience, chief among whom was the English astronomer Dawes, from whose drawings Proctor constructed in 1870 the first detailed map of Mars.

The conception of our neighbour world which was then current was summarised in Proctor's phrase—"Mars, the miniature of our Earth." It was assumed not only that the polar caps were masses of snow and ice, but that the reddish-ochre portions comprising the greater part of the planet's surface represented the continents, while the blue-green areas were the oceans. It had long been known that Mars had an atmosphere, and clouds and mists had occasionally been observed. Points of difference between our Earth and Mars had, of course, been noted—for instance, the much smaller area of the Martian disc occupied by seas—but on the whole the work of the earlier nineteenth-century observers seemed to confirm Herschel's opinion that "the analogy between Mars and the Earth is perhaps by far the greatest in the whole Solar System."

A new era in the study of the planet was opened in 1877 when Schiaparelli, the greatest Italian observer of last century, commenced at Milan his long-continued series of observations. Something of a sensation was caused by his announcement that the continental areas were intersected by a number of straight dark lines, to which he gave the name of *canali*. It subsequently transpired that Dawes and Secchi had actually seen and drawn some of these markings, but had simply classified them as straits. To Schiaparelli, therefore, belongs the honour of first recognising their true nature. At each subsequent opposition, Schiaparelli detected new canals, and in 1879 and again in 1881 he observed that a number of them appeared to be double; but it was not till 1886 that Schiaparelli's discovery was confirmed by Perrotin and Thollon, of the Nice Observatory. Within the next decade, however, many observers, both in Europe and America, succeeded in seeing and drawing these strange markings; and as the canaliform appearance was gradually established as a true characteristic of the Martian disc, numerous theories were advanced in explanation of it. Most of these, such as the hypotheses that the canals represented mountain chains or huge fissures of enormous breadth and width, have only a certain historical interest. More plausible was the view originally advanced by Cerulli, of Teramo, developed by Newcomb and championed by Maunder, that the phenomenon of the canals "grows out of the spontaneous action of the eye in shaping slight and irregular combinations of light and shade, too minute to be separately made out, into regular forms." This theory had a certain vogue for a considerable time, but it may be said to have been discredited by the observations of the past thirty years, and more especially by the success of the observers at the Lowell Observatory, in 1905 and at subsequent oppositions, in photographing the more prominent canals.

Recognising the importance of clear and steady air for study and interpretation of the Martian markings, two of the ablest American astronomers inaugurated, early in the last decade of the nineteenth century, astronomical observatories of a novel type. In 1892 Professor W. H. Pickering commenced observations on Mars from the Harvard College station at Arequipa, on the slope of the Andes, in Peru, and this work he still carries on at the Harvard branch observatory at

Mandeville, Jamaica. In 1894, maintaining that "observatories should be erected where they may see rather than be seen," Professor Percival Lowell, of Boston, founded and equipped the Lowell Observatory at Flagstaff, in Arizona. Here for the period of twenty-two years, until his premature and lamented death in 1916, Lowell untiringly scrutinised the surface of Mars, following the planet for long periods both before and after opposition. The work of Lowell, Pickering, and the various observers who have assisted



MARS 1907, July 8-12. (LOWELL OBSERVATORY.)

and collaborated with them has in great measure revolutionised our knowledge of Mars.

The observations of Schiaparelli himself had cast doubt upon the aqueous character of the so-called "seas"; and W. H. Pickering's observations in 1892 still further weakened the conventional theory. In 1894 Lowell and his assistant, Douglass, announced that the canal-system was not confined to the reddish-ochre or continental areas, but was planet-wide, the canals traversing the so-called oceans as well as the continents. It became obvious, therefore, that there are no permanent bodies of water on the Martian surface, the so-called seas are simply low-lying tracts of vegetation, and that the only "seas" on our neighbour world are temporary—the polar seas which result from the melting of the ice-caps in the spring and summer, and the temporary floods which overspread low-lying areas from time to time.

Of special significance was Pickering's detection, in 1892, of round spots at the junctions of the canals, the existence of which Schiaparelli had suspected, but had never been able to place beyond doubt. These were called "lakes" by their discoverer, in keeping with the older views of the planet's physical condition. This discovery was confirmed by Lowell, who detected considerable numbers of these spots; he designated them as "oases," in keeping with the newer view. For Lowell demonstrated beyond doubt that the continental areas are desert lands—"not only land, but nothing but land—land very pure and simple; that is, deserts." The dark lines designated as canals and the dark spots at their junctions were shown to be vegetal in their nature, as Schiaparelli suggested soon after their discovery. For the canal-system is obviously dependent upon the polar cap. As the cap melts the canals darken, and a wave of verdure sweeps from pole to equator and into the opposite hemisphere. Obviously the melting of the snow-fields, on a world where water is scarce and where the air is clear and dry, is the controlling factor in the planet's physical life. In some manner the narrow strips of vegetation which we call canals are fertilised by water from the polar seas, which are formed from the melting snows.

Here certainty ends, and we must be content with hypotheses more or less plausible. The most thoroughgoing and elaborate theory is that which Lowell enunciated in his first book on *Mars* in 1895, and developed in his later volumes—a theory which is familiar even to the casual reader of scientific literature. In his view, the canal-system can only have come into existence as the result of intelligent agency. Mars is relatively a much older world than ours, in the later stages of planetary existence. Water is scarce, and if there are inhabitants there, they must be fighting a grim battle against the spectre of death by thirst. The geometrical regularity of the canal-system, and the rate of development of the individual canals —indicating a transference of water "in the face of gravity"—were held by Lowell to point to the existence of intelligent life on the planet, at least within the areas which he termed "oases," and which he believed to be centres of population or "city-states."

Various alternative theories have been put forward, and from time to time Professor Pickering has outlined possible explanations of the canals. In 1915 he suggested that the water necessary for the growth of vegetation in the strips known as canals might be

artificially drawn from the atmospheric circulation of the planet, or, alternately, that fogs might be artificially localised by electrical means—a theory which would obviate the necessity of believing in a world-wide system of irrigation. In 1918 he put forward another hypothesis, in which he seeks to explain the canals without having recourse to the theory of intelligence. According to this "aerial deposition theory," "the water from the melting polar cap is deposited on the three main depressions on its border, and is then evaporated and carried by the aerial circulation of the planet along the curved lines which in accordance with Ferrel's theory of the winds it must necessarily follow. The storm clouds, which in that rare atmosphere should condense at night, would in this manner carry the water and deposit it in the elongated marshes which we see and call canals." This hypothesis, however, can hardly be called wholly satisfactory, and it must be admitted that Lowell's theory—startling though it is in its implications—would seem to be more capable of explaining the observed facts than the alternative hypotheses.

Recent astronomical research has emphasised the difference rather than the analogies between Mars and the Earth. Thus we know that the surface of Mars is comparatively flat—that there are no mountains worthy of the name on our neighbouring world ; nor are there any large bodies of water on the Martian surface ; if ever there were permanent oceans they have long since disappeared. The planet's atmosphere, too, is very rare—" thinner at least by half," according to Lowell, " than the air upon the summit of the Himalayas " ; and its surface-pressure, Pickering believes, is likely to lie between one-half and one-tenth of that at the Earth's surface. The Martian atmosphere is much clearer than ours. It is not, however, absolutely cloudless. " Clouds," Pickering wrote in 1914, " are nearly always visible on the disc, but they are not usually reported because they are difficult to observe. . . . In the polar regions the clouds are sometimes so white as to be with difficulty distinguished from the snow. After they have disappeared at the poles, the ground is often seen to be white with freshly-fallen snow. Sometimes cloud-masses partially conceal a whole hemisphere, and cloudy nights appear to be frequent." During the opposition of 1920, the observers at the Lowell Observatory were impressed by the unusual haziness and cloudiness of the Martian atmosphere. But we may say that Mars is usually a world of blue skies and bright sunshine.

Despite the greater distance of Mars from the Sun, the difference in temperature does not appear to be so great as might be expected. It has been calculated that the theoretical mean temperature is nearly 0° F.—considerably below the freezing-point of water. But this estimate is totally at variance with the observed facts, and the presence of vegetation, and the obvious existence of water in a liquid state, indicate a much higher temperature. For of the existence of water there can be no doubt, the lines of water vapour having been identified in the Martian spectrum by Huggins and Vogel, and conclusively by V. M. Slipher at the Lowell Observatory in 1908. In his last book, Lowell, from a theoretical conclusion based not only on distance but on the transparency of the Martian atmosphere, found the mean temperature of the planet to be about 48° F., which agrees with observation.

Mars differs from the Earth in the absence of any satellite of appreciable size. Until about half a century ago, indeed, it was believed that Mars possessed no moons, and the discovery by Asaph Hall at Washington during the memorable 1877 opposition, of two tiny satellites, was quite unexpected. These two moons are very small, appearing as stars of about the tenth and twelfth magnitude. Phobos, the larger and nearer of the two, would appear to have a diameter of about thirty-six miles, and Deimos, the more distant, of about ten miles. Obviously, these little satellites belong to an order of bodies altogether inferior to our Moon, and it is not impossible that they may be asteroids which have come in the course of ages within the sphere of influence of Mars and thus been captured.

Venus

Venus is our nearest planetary neighbour, and has been defined as the Earth's sister world. Nevertheless, our actual knowledge of our nearest neighbour is very scanty. When nearest to us, Venus is directly between the Earth and the Sun and is invisible ; and in addition we never see the planet as a fully illuminated disc. The thick atmospheric envelope, too, with which Venus is surrounded renders the discovery of surface detail a matter of great difficulty. For over three centuries astronomers have scrutinised its surface, yet to-day even the length of its rotation period is a matter of uncertainty. Cassini, in 1666, concluded that his observations pointed to a rotation period of about 23 hours ; and this estimate was confirmed by the German astronomer Schröter in 1789 and again in 1811, and in 1844 by Di Vico, of Rome, who fixed the length of the planet's day as 23 hours 21 minutes 22 seconds. These results, however, did not inspire much confidence. For Herschel, by far the greatest planetary observer of his day, was quite unable to see the spots which Schröter had used to determine the rotation period. The diurnal motion, he said, " on account of the density of the atmosphere of this planet, has still eluded my constant attention, so far as concerns its period and direction."

In 1877 Schiaparelli turned his attention to the

problem, and for a period of thirteen years he kept the planet under observation, following it for long periods in the daytime. His conclusion was a startling one—that, so far from the period being of 23 or 24 hours, it synchronised with the period of revolution—225 days. This result indicated that Venus turned one face constantly toward the Sun, and that in one hemisphere there is perpetual day and in the other everlasting night. This conclusion was confirmed in 1895 by a second series of observations by Schiaparelli himself; and by Perrotin at Nice, Tacchini at Rome, Cerulli at Teramo, and in addition by Lowell at Flagstaff, Arizona. Nevertheless other competent observers, including Flammarion, were satisfied that the rotation was performed in a period of about 24 hours.

About twenty years ago, the spectroscope was applied to the solution of the problem. By means of Doppler's principle, Bélopolsky, the Russian astronomer, arrived first at a period of 12 hours and later of 24 hours, while Lowell and his assistants at Flagstaff found that "the evidence of the spectroscope is against rotation of short duration, and so far as its measure of precision admits, the investigation confirms a rotation of 225 days."

Last summer, Professor W. H. Pickering announced the results of his observations on Venus during the favourable appearance of the planet in the previous winter. In December 1920 Pickering detected two dark spots near the terminator, and by following these spots — their appearances and disappearances — he reached the conclusion that the planet rotates in a period of 68 hours, and that the axis of rotation lies very nearly in the plane of the planet's orbit. So far this is the last word on the subject. If Pickering's rotation period prove to be accurate, it may be possible to reconcile the discordant results reached by distinguished observers.

That dark markings and dusky shadings appear from time to time on the dazzling disc of Venus admits of no doubt. It is, however, difficult to speak with any confidence as to their nature. They may represent irregularities in the surface, as has been generally maintained; or, as Pickering suggests, they may be due to breaks in the cloud-laden atmosphere. White spots have been suspected from time to time, and occasionally brilliant markings have been seen, and interpreted as polar caps or as the snow-clad summits of high mountains; but there is no certainty concerning the reality of these appearances.

Mercury

If little is known of Venus, still less is known of Mercury, the smallest of the four dwarf planets. Mercury is situated much closer to the Sun than Venus; it is a small world—only 3,000 miles in diameter—and it is comparatively at a great distance from us. The first systematic series of observations was made by Schröter at the beginning of the last century. This patient though not brilliant observer discovered that the southern horn of the Mercurial crescent presented a blunted appearance—a fact which he attributed to the existence of a high mountain or mountains. He also reached the view that the planet's rotation was performed in a period of about 24 hours. This estimate was not received with any degree of confidence; yet Schiaparelli's announcement in 1889, at the close of his seven years' study of Mercury, that the period of rotation equalled that of revolution, was received with a certain degree of scepticism. His conclusion, however, was abundantly confirmed by Lowell at Flagstaff, and it is now generally conceded that Mercury turns always the same face to the Sun just as the Moon does to the Earth. This conclusion, in the case of Mercury, is theoretically confirmed by Sir George Darwin's hypothesis of tidal friction.

Mercury, in fact, seems to resemble the Moon more than any other celestial body. The balance of evidence would seem to favour the view that the little planet has no appreciable atmosphere, and that its surface is rugged and mountainous. According to Lowell, whose observations were prolonged and exhaustive, the dark markings which revealed themselves to his search merely represent huge cracks in a barren and lifeless world; "the surface of Mercury," he concluded, "is colourless—a geography in black-and-white." Mercury, then, would seem to be a slightly larger edition of the Moon—a world in the last stages of planetary decrepitude.

(*To be continued*)

The Courtship of the Red-throated Diver

By Julian S. Huxley, M.A.

Fellow of New College, Oxford

Bird photography is a splendid sport. In so far as it is a sport, it is an end in itself. Looked at objectively, it has the further great advantage that it does not destroy but helps to preserve; those who have watched a bird for days together from a hiding-tent will never wish to kill the creature whose inmost life has been displayed before their eyes. Further, like any sport, it brings with it knowledge of its objects. But while the bird photographer cannot help acquiring much intimate knowledge of the birds he photographs, the acquisition of knowledge is not his main aim, and too often his opportunities for enlarging science are wasted.

I have elsewhere [1] drawn attention to our extraordinary ignorance regarding the habits of many even of our common birds. Isolated facts are something, but systematic observation and thought, systematic about what one observes, are needed to lighten the darkness.

The observations here recorded were made in Spitsbergen on the Oxford University Expedition in July of last year. The photographs accompanying the article are incidental only, for, alas! it was impossible to secure photographs of any of the courtship activities, as these take place on open water away from the nest. I have therefore had to supplement them with thumb-nail sketches, which I think are better than no illustration at all.

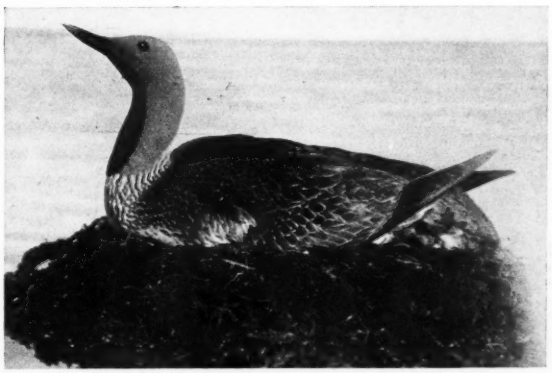
The Red-throated Diver presents a particular instance of a problem which has long exercised me. In the Divers, as in the Grebes, the Herons, the Cranes, and many other birds, both sexes are alike, and both brightly coloured; and, as we shall see later, the bright colours are used in courtship. When one sex only has special ornaments, be they of colour, structure, scent, or voice, we can fall back upon some modification of Darwin's famous theory of sexual selection. In such case, the ornaments of one sex are an assistance to successful mating; for the members of the other sex exercise some sort of discrimination, and are not equally pleased or stimulated by all cock birds. Thus there is a growth of ornament in one sex which is determined in the long run by the "taste," if we may use the word in a somewhat metaphorical sense, of the other sex. The theory has had to be modified in various minor respects, but its main principle holds firm: that the female needs stimulating, that stimulation is provided by the beautiful and by the strange in the male, and that therefore the mind of the female exerts a selective influence in evolution over these special male characters.

What, however, are we to make of the facts when both sexes have bright colours, or special structures, like the Grebe's ruff or the Egret's plumes, which all analogy would lead us to suppose were used in courtship?

The puzzle is still far from being completely solved. But my previous observations on the Crested Grebe and various Herons and Egrets, like those of Edmund Selons on Grebes, Guillemots, Fulmars, and other birds, have at least led to two perfectly straightforward results. In such cases the bright colours and special structures *are* used in courtship (using that word in an extended sense to cover all ceremonies based upon the sexual emotion); and they are almost always used by both sexes in equal degrees. The habits of the Diver corroborate these results.

The terrain of my observations was the eastern edge of Prince Charles Foreland, a sixty-mile island off the west coast of Spitsbergen. Between the central mountain backbone and the sea there extended a comparatively flat strip of land, a mile or so in width, with small scattered lochs—the nesting-places of the Divers. Close to our camp there was also a large brackish-water lagoon, about five miles in length, separated from the sea only by a narrow spit of shingle; here the birds often came to rest and to fish.

In this latitude the Divers have a very short season in which to bring off their young. When we arrived, on June 30, the little lochs were all quite, or almost quite, frozen over, and nesting was out of the question; and September brings the rapid autumn. It is therefore imperative for the birds to start nesting as soon as they can; that they do so is shown by the fact that I found a nest with one egg only seven days after the first sign of thaw in one loch, another nest with the complete complement of two eggs eight days after the beginning of the thaw in another loch. The first nest was within three or four yards of a snow-bank.



THE RED-THROATED DIVER ON ITS NEST.

In passing, some of the curious methods of progression of the bird may be noted. The nest is always somewhat raised to protect the eggs from possible floods, and is often at some yards' distance from the water. When the water is very shallow, the Divers progress by their well-known but none the less extraordinary method of resting their breast on the ground, and then giving a great kick with their legs so as to propel the whole body upwards and forwards, the breast coming down again with a bump. In this action, the hind-quarters are disproportionately raised and the motion is like that of a very clumsy rabbit slowly moving forward. When there is a stretch of dry land to cover, the bird may walk erect; but it can only advance a few yards at a time in this way, dropping down to rest for a little before trying the erect posture once more. I say "erect posture," but it is a travesty of the erect posture that the bird adopts. The legs are placed so far back that the body leans a

[1] *Proc. Zool. Society*, 1914; *The Auk*, 1915.

little forward ; and the neck, presumably so as not to throw the centre of gravity further up, is bent down in an ugly curve half-way to the ground. The bird only saves itself from falling forwards by moving, and can only do so, as I said, for a short time.

On reaching the nest, she almost always, while still standing, carefully presses the two eggs well into her feathers with her beak, then sitting down and rolling from side to side to get them comfortable. After a few minutes she will usually rise and rearrange the eggs.

I was watching the nest with one egg, referred to above, with a telescope, from a hiding-tent some forty yards away. The hen had been sitting steadily for several hours, protecting the egg from marauding skuas and gulls. Suddenly her mate flew down onto the

A REMARKABLY FEARLESS DIVER SNAPPING AT AN INTRUDER (THE WRITER).

pool. Almost at once she left the nest, made towards the cock, and swam round him several times with her neck extended in front of her—a snake-like pose, but one rigid with excitement. However, he was unresponsive. Soon after, she gave what I call the "splash-dive." The bird dives with a flick, sending a shower of spray into the air (as opposed to the noiseless submergence of serious diving for food), to emerge only a few feet away, always close to its mate. This was repeated four or five times, and stimulated the cock to a little similar diving. I have since found that this splash-diving is always associated with excitement (sometimes with quite other forms of excitement, as when one very tame bird employed it in anger when I drove her off her nearly-hatching eggs), and seems to be especially used as a stimulus by one bird of the pair—it may be either male or female—to key up the emotions of the other. Immediately afterwards they swam together to a low bank of green moss, onto which the cock scrambled. He stood upright, stamped alternately with his feet, and sank down to rest. I found later that he was sitting on a rudimentary nest, a "cock's nest," such as also is built by the Crested Grebes ; and found a similar cock's nest on the other nesting-pool that I was able to investigate thoroughly.

The cock picked at the moss, and seemed to be building pieces of it into the "nest." The hen meanwhile, although the water was scarcely deeper than herself, was giving splash-dives over and over again. On a subsequent visit to the same place she occupied herself in ducking under, pulling up great pieces of moss from the bottom, throwing them aimlessly over her shoulder, and repeating the process.

From what I afterwards saw, it became clear that each pair had a special place, like this moss-bank, where there was a cock's nest and where the act of pairing always took place—a nuptial bower.

Two points deserve special notice. First that in other species where such special pairing-places are found, they usually contain a rudimentary nest ; for instance, in the Crested Grebe. This bears out Selous' contention that the whole sexual life of the birds originally centred round the nest, and that now we see a "division of labour" between the two functions of the nest—the incubatory in the true nest, the nuptial in the rudimentary nest by the pairing-place.

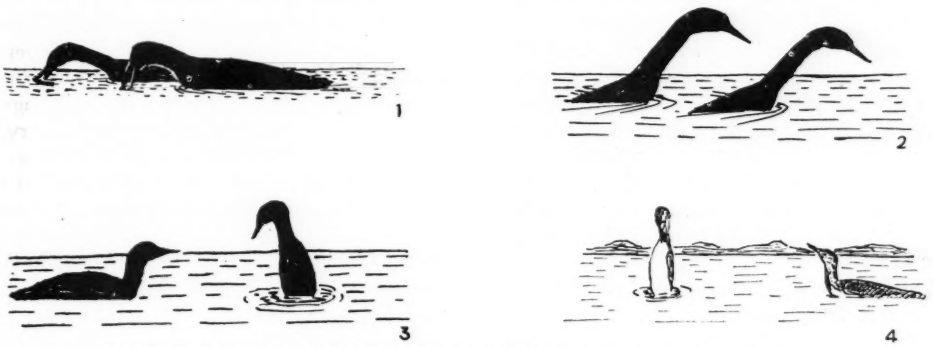
Secondly, and in a way arising out of the first, we have the strong association between nest-material and the emotion of love. This association is by no means confined to species which have special pairing-places. To choose but three examples, not only does the grebe have elaborate ceremonies in which bunches of weed dived for from the lake-bottom play a prominent part, but herons and egrets present each other with twigs to an excited ceremonial accompaniment, and the mates of warblers often make their displays before the hens with a leaf or twig held in their beak. Mental association, in fact—and this is an important general conclusion—plays a large part in building up the complicated courtships of birds, and so presumably in their whole mental life.

The mate of this particular pair of mine shortly flew off, but returned again later in the day. This time, the typical ceremony of the Diver's married life was gone through. After some preliminary diving, the two birds both put themselves into the characteristic position. The neck was arched right forward, the head bent down ; the beak was open, and its lower third or half was submerged in the water. From both birds issued an extraordinary cry, which in my notes

is described as "a growl with a bubble in it," and a "rolling groan"; perhaps I may leave it at that! In this position they swam rapidly across the pool, the male leading, uttering the cry again and again; they then turned, and repeated the process, but with the female now leading; then stopped, and resumed the ordinary business of life. We may call this form of courtship the "beak-dipping ceremony."

This was the commonest ceremonial of the birds. I saw it both on the little lochs and on the big lagoon, and the strange guttural cry that was its sure accompaniment came often to our ears, at all hours of day and night.

As far as ceremonies later than the time of pairing up are concerned, the Diver is very similar to the Crested Grebe, but with much less variety of courtship action. The main point of resemblance is that both male and female birds play either interchangeable or identical rôles; there is no courting of one sex by the other exclusively, as in peafowl or black game or warblers.



(1) THE BEAK-DIPPING CEREMONY. (2) THE PLESIOSAUR RACE. (3) and (4) VERTICAL EMERGENCE FROM DIVING.

I was particularly lucky, however, in seeing a good deal of the earlier stages of courtship, those which lead to the selection of mates for the season. These are notoriously difficult to observe in most birds; here it was largely our good fortune in being close to the lagoon which helped me to this result. The lagoon served as a common rendezvous for all the Divers in the neighbourhood. Sometimes they would fly out to sea to fish, or across to the other side of the island; but a great deal of their fishing, and, above all, of their resting and their courting, was done on the lagoon's tranquil waters. I have seen as many as ten scattered birds on it at once, and little flocks, real social gatherings of five or six, were not uncommon.

During our first four days, the lochs were all frozen over, and nesting was impossible; it was then that the selection of mates was going on most rapidly. As is usual with bird-watching, we at first found the creatures' antics quite unintelligible. Among a group on the lagoon, there would suddenly be a commotion; birds would be seen—usually a trio, but sometimes two and sometimes four—ploughing the water in an extraordinary attitude. Their bodies would be submerged (this power of voluntary submersion of the body being common to all Grebes and Divers), but tilted up in such a way that just the breast and shoulders were above water. The neck was stretched stiffly up and forwards, about 30° in front of the vertical; and the head inclined slightly downwards. In this attitude they had a very remarkable appearance, like miniature Plesiosauri restored to life. Again, as often in birds' ceremonials, there was a tense, rigid look about their attitude. Resistance to movement must have been considerable, as a wave was thrown off from their advancing breasts. In this attitude they would progress for a considerable distance, less as if one of them were being pursued than as if all were running some form of race. (In fact we christened the ceremony "the race of the Plesiosauri.") Then they might turn about, and come back with a different member leading.

At other times they would give the same performance but raised to greater heights of excitement, the wings spread and drooped and beating the surface of the water.

Then we repeatedly saw the extraordinary spectacle of one bird diving to emerge close to another in a nearly vertical position. The whole white undersurface would be exposed to view, the bird seeming almost to stand on its tail in the water, and then slowly settling down to a sitting position. This vertical emergence, too, is paralleled in the behaviour of the Crested Grebe.

When it is remembered that the performance characterising mated pairs was also to be seen on the lagoon, that "splash-diving" was frequent, that fighting and jealousy often gave rise to much confused action, and

finally that all this had to be observed through a telescope, it will be understood that my first feeling was one of bewilderment.

Gradually, however, order began to come out of chaos. The "Plesiosaur" attitude and the racing, it was found, are used only in the period before mating up; that is why three (or even four) birds usually participated in them—it is in a sense a competition for a mate. Unfortunately the two sexes are difficult to distinguish. The female is smaller and more delicately built—that is all. Sometimes identification is certain, sometimes almost impossible. However, I can at least say that it is highly probable that such trios might consist of two cocks competing for one hen, or two hens competing for one cock. In any event there is no doubt that they are competitive in the sense that they play a part in the selection of mates; and no doubt that there is no display of one sex before the other, but ceremonial and emotional actions identical in the two sexes. The Diver is, so far as I know, the first species in which this has been shown to be so, although I have no doubt that in many birds with both sexes similar the same will prove true.

The diving and emergence in vertical position is also, so far as I could judge, only used in this first, unmated, period. It seems to be employed more as a definite means of excitation, a display, but again, almost certainly, by either sex. At any rate, in the only two cases, where I could be sure of the sex, the performer was a female.

A curious psychological fact remains to be mentioned. It was first noticed by Mr. Elton, another member of our party, that the birds on the lagoon would often immerse part or all of their beaks and sometimes their whole head, as if looking for fish. Later we became puzzled as to why this action so often seemed to be a prelude to courtship ceremonies; and finally I became convinced that it was, through some obscure mechanism of the brain, definitely associated with them. I had previously found that in the Crested Grebe both the shaking of the head and the strange aimless attempt at preening the wing-tips and tail were similarly associated with courtship actions. We can only suppose that actions, originally neutral, have been seized upon by the forces of sexual selection and used as the raw material of the strange ceremonies of sex. In the Grebe it is quite certain that the commonest form of nuptial courtship action, in which the ruff is spread and the head violently swung from side to side, is simply a specialisation and ritualisation, as one may call it, of the ordinary shaking of the head seen when water-birds preen themselves. It is possible that the curious habit of the Divers in holding their beaks half-immersed during the mutual "beak-dipping ceremony" that I have described, has its origin in the holding of the head under water when looking for fish. In any case, we have here one further example of the strange ways in which mental association works in birds.

I had almost forgotten to mention that the voice plays an important part in the post-nuptial courtship. Those who know the Red-throated Diver will remember the extraordinary wildness and sense of pain in the bird's mewing, cat-like howl. That we are really reading much of this emotional tone into the cry is shown by the fact that it is used in courtship. Very often as a preliminary to the beak-dipping ceremony there will be a duet of these wild cries; and eventually, whenever I heard such a duet—and it was easy to hear, since it carried for miles through the Arctic solitude—I got my glass ready to look at the rite which I knew would follow. Here again we have a ceremony shared mutually by both birds of a pair, but appealing to the ear instead of wholly or mainly to the eye; and this again is paralleled by the love-duets of the Dabchick and of some species of Owls.

In these various ceremonies the bright colouring of the birds is shown to the best advantage. In the "Plesiosaurus Race," the drab body is hidden, the lovely pencillings of the back of the neck visible to the hinder birds; the same is true of the ceremony with submerged beaks. In the splash-dive, on the other hand, the delicate blue-grey of the rest of the neck, with its rich chestnut throat patch, comes into view; this it does also, but now with the additional revelation of the whole of the flashing white belly, in the vertical emergence after diving.

Enough will have been said to show that the Diver's courtship is characterised by strange ceremonies, in which both sexes play an equal part. In conclusion, let me ask anyone who may be in a position to fill any of the gaps in my observations to be so good as to write to me with the information. I shall be most grateful. Especially interesting would be observations on the first period, before mating up, in Great Britain.

The Renascence of the English Short Story—I

By Thomas Moult

THE English short story, being the youngest product of literary art, is still regarded with mixed feelings by the average reader of books. *Berenice* was, we are told, practically the first of its kind in English prose, and because it was written by a master like Edgar Allan Poe (1809-49), an audience must have been automatically created for it. That audience does not

appear to have increased to any considerable extent while transferring its attention to Poe's imitators and successors during the eighty-six years that have intervened between *Berenice* and the present ; so that even to-day we have the curious anomaly of a reading public which either regards the form as the especial prerogative of its own favourite writers, or is only willing to look at the work of a writer whose name is unfamiliar if that work is printed in the pages of a popular magazine.

Scarcely anyone buys volumes of short stories unless they are written by Rudyard Kipling, W. W. Jacobs, O. Henry, or Jack London. Only once in its history does the art appear to have reached anything like general prosperity in England. Twenty years ago all the best authors were regular practitioners, the literary periodicals encouraged it, and for the most part it actually rivalled novel-writing in the regard of the reading public, that previously had failed to appreciate it and has been backsliding ever since. It was almost as if readers were taken by the scruff of the neck and compelled to a temporary transfer of their attention. In fact they were victimised by their own favourite authors. A sudden rivalry had sprung up between a dozen first-rate men. Kipling and Conrad contributed some of their best work as short stories, and among others who pursued the art energetically one remembers "Max" and "Q," Zangwill, Jacobs, Morley Roberts, Arnold Bennett, Charles Marriott, the late Stephen Crane, and H. G. Wells.

It is one of this group, indeed, H. G. Wells, who has given the most attractive if not very technical description of the short story. That its period of popularity should have come to an end so swiftly and ingloriously is little short of amazing if we consider how attractive, how surely cut out for popular favour, is the art as there defined. "It is the jolly art of making something very bright and moving," says Wells ; "it may be horrible or pathetic or funny or beautiful or profoundly illuminating, having only this essential, that it should take from fifteen to fifty minutes to read aloud." But Wells has now forsaken the short story for historical tomes, Arnold Bennett for meditations on the frailty of women, and "Q" for Cambridge class-rooms. Only Max Beerbohm, W. W. Jacobs, and Morley Roberts seem to have been faithful to their old pursuit. Perhaps the desertion of the others is due to the fact that, coincidently with the short-story vogue, a second fashion was setting in, a product of an era of scientific discovery, whose significance was about that time beginning to impress the general mind. To despise the literature of plot and incident, seeing value only in the analysis of psychological processes, was a habit that formed itself without opposition among the more thoughtful type of authors.

In the light of later events we can see that this was the beginning of the end of the short story in its then (1890–1905) legitimate sense of the word. Not that to attempt a technical definition as distinct from H. G. Wells's generalisation is an easy matter. We are in danger of limiting the term so closely as to exclude narratives which may properly be regarded as falling into this class of fiction : or we may make the definition too inclusive. There are, as a matter of truth, so many kinds of short story that it would be less difficult to say what the short story is not. For example, it is neither a novel, condensed novel, nor novelette. Its plot is hardly ever complex, it is not a sketch (which is a still life affair, while the short story requires movement), nor an anecdote—and this rules out a good deal of O. Henry's work, and also such vague generalities as that of the editor of an American magazine which prides itself on its "short stories." The business of the writer is, says this editor, "to make a real impression without taking pages to accomplish it in, to reach the human heart in a human way, inspiring in the reader, by the use of not more than two or three thousand words, a genuine emotion of love, awe, and pity." All of which demands even the anecdote may easily meet.

Before proceeding further we had best here lay down that the short story is a single-themed narrative, artistically presenting characters in a struggle or complication which has a definite outcome. If the action occurs in a brief time and in a closely circumscribed space, the story approaches the ultimate or ideal type. *Swept and Garnished*, by Rudyard Kipling, *The Idiot*, by Arnold Bennett, and *The Three Strangers*, by Thomas Hardy, each in their separate ways, by closely observing the limitations of time and place, consciously or unconsciously obey the laws of the Unities of Place, Time, and Action laid down for the Drama by Greek critics. Contrariwise, *The Jumping Frog*, by Mark Twain, and Jack London's *Love of Life*, prove the elasticity of the form as regards these Unities.

But in each of these stories, whether they be elastic or rigid, we have the concentrated imaginative form, whose justification for existence once seemed to be the tale it contained. Three of them are written by men who either had a share in that prosperous period of twenty years back, or were the direct product or survival of it. With the decline of prosperity for the short story, literary style became of exaggerated importance, and the subject insignificant. The new writer recorded a "phase," an "episode" There was no longer any vital necessity, aspirants were told, for more than a single character ; and, being a physical figure, even this one character hardly counted, nor did it matter if the action, all told, amounted to no more than the lifting of an eyebrow !

For purposes of comparison, let us take an example from each period—that which may roughly be defined as the period of "plot," in which the story told was of primary importance; and that of "phase" or "episode," in which the method of the story-teller mattered to a degree which would make the authors a fit study for the psycho-analyst. In *Mary Postgate*, by Rudyard Kipling, there is an episode of bomb-dropping. After the explosion, Mary and Nurse Eden heard "a child's shriek, dying into a wail":

"Nurse Eden snatched up a sheet drying before the fire, ran out, lifted something from the ground, and flung the sheet round it. The sheet turned scarlet, and half her uniform too, as she bore the load into the kitchen. It was little Edna Gerritt, aged nine, whom Mary had known since her baby days.

"'Am I hurted bad?' Edna asked, and died between Nurse Eden's dripping hands. The sheet fell aside, and for an instant, before she could shut her eyes, Mary saw the ripped and shredded body."

Between them, restraint and suggestion are the principal factors in creating the emotional effect here. Which simply means that the writer who cares more for matter than manner generally does well with both, for it is the actual incident described that leads to restraint and suggestion. Against this we may set a passage from Henry James's *The Real Right Thing*, in which the author is speaking of George Withemore, who has been asked to write the life of Ashton Doyne, deceased; nor is the author caring for anything half so much as the actual words he is speaking:

"He was not a little frightened when, even the first night, it came over him that he had really been most affected in the whole matter, by the prospect, the privilege and the luxury of this sensation. He hadn't, he could now reflect, definitely considered the question of the book—as to which there was here even already much to consider; he had simply let his affection and admiration—to say nothing of his gratified pride—meet to the full the temptation Mrs. Doyne had offered him.

"How did he know without more thought, he might begin to ask himself, that the book was on the whole to be desired? What warrant had he ever received from Ashton Doyne himself for so direct and, as it were, so familiar an approach? Great was the art of biography, but there were lives and lives, there are subjects and subjects. He confusedly recalled, so far as that went, old words dropped by Doyne over contemporary compilations, suggestions of how he himself discriminated as to other heroes and other panoramas. He even remembered how his friend would at moments have shown himself as holding that the 'literary career' might—even in the case of a Johnson and a Scott, with a Boswell and a Lockhart to help—best content itself to be represented. The artist was what he did—he was nothing else. . . ."

With this type of short story in the ascendancy (more or less modified, of course, because no writer except James has dared to pursue the method to its logical extreme), it was inevitable that what is a distinct and significant branch of art should have suffered a serious decline. There was still a demand for the short story of plot and incident, and while the older magazines vanished one by one from sheer lack of material, a new and much inferior type of periodical sprang up and took advantage of a public taste which, in the desperation of hunger, had forgotten to discriminate between art and mechanics. The consequence was that a very inferior type of short-story writer sprang up also.

(*To be continued*)

Modern Whaling

By J. Travis Jenkins, D.Sc., Ph.D.

FORMERLY whales were hunted from rowing-boats by means of a hand-harpoon and lances. The chief species hunted in this fashion were the Right or True whales (*Balænidæ*), and the Cachalot or Sperm whale (*Physeter*). Owing to over "fishing," these species are now so rare that it no longer pays to fit out vessels for their capture. Whaling was consequently rapidly dying out until the invention of a harpoon-gun by a Norwegian sailor, Svend Foyn, in 1864. The capabilities of this gun were not at first realised, and it was not until about 1880 that any considerable development took place. This development was due to the fact that with the harpoon-gun it was possible to kill and capture Finner whales, whose rapid swimming and tendency to sink when dead rendered them immune to the attacks of the old whalers.

The three chief whales, all species of Finners, on which the modern whalers of the North Atlantic depend are the Blue whale (*Balænoptera sibbaldi*), the largest of all living creatures, which sometimes attains a length of 85 feet; the Common Rorqual (*Balænoptera musculus*), and the Sei whale. The first, like the other species of Finners or rorquals, spends the winter in the open sea, approaching the coast at the end of April or the beginning of May. The Common Rorqual grows up to 70 feet in length, and is the commonest of the large whales off the British coasts. It feeds on fish, and is frequently seen among the herring shoals. The Sei whale is a smaller edition of the Common Finner, attaining a length from 40 to 50 feet. Until recently it was considered the rarest of the European whales, but in 1906 no less than 326 specimens of this species were taken by the Norwegian

whalers in Scottish waters, and in normal seasons it forms from 50 to 80 per cent. of the total catch in Faroese waters. These Finners are readily distinguished from the True whales by the presence of a dorsal fin and the plicated skin on the throat.

Normally there are whaling stations at work in the Shetlands, Hebrides, Ireland, Iceland, and the Faroes, but last year, owing to the slump in the value of whale oil, only one station was at work, at Thorsvig in the Faroe Islands. Nearly all modern whaling is in Norwegian hands, and it was a Norwegian firm which had four whaling steamers at work at Thorsvig this year.

The whaling steamer is a small but strongly built vessel from 80 to 90 feet in length. Its characteristic features are the crow's-nest up on the solitary mast and the harpoon-gun in the bows. The harpoon, to which a rope is attached, is shot out from a small cannon fixed right up in the bows of the steamer. The harpoon is tipped with a hollow point called the bomb. This bomb bursts after the harpoon strikes the whale, and often kills the whale instantaneously. Coiled on a pan in the bows is about forty fathoms of a specially strong rope, the Foreganger. From this pan or platform, the rope passes aft to a winch situated in front of the bridge. This winch serves to haul in the whale when it is dead.

Most of the whales are captured at the Faroes within the 100-fathom line, less than a day's steaming

FIG. 1.—THE HARPOON IN WHALER'S BOW, WITH PLATFORM FOR COIL OF ROPE.
The gun is unloaded, and the muzzle points aft.

from the islands. This year, owing to the abundance of the Common Finner, the whalers made no attempt to kill the Sei whale, which in normal years forms the greater proportion of the catch at the Faroes. Up to the middle of July, of a hundred whales taken at Thorsvig, ninety-seven were Finners and three Blue

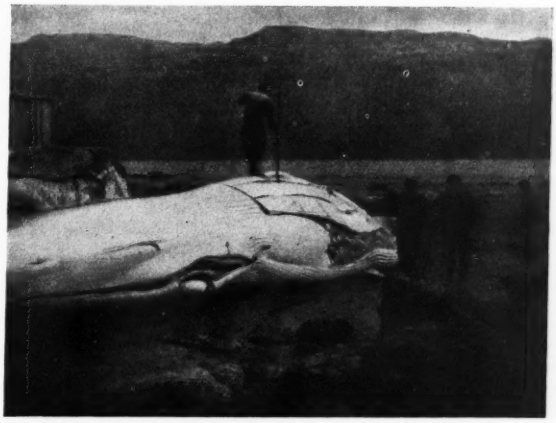


FIG. 2.—FLENSING A FINNER WHALE (*BALÆNOPTERA MUSCULUS*).
THORSVIG, FAROE ISLANDS.

whales. Occasionally one of the rarer whales is killed, a Nordcaper (*Balæna biscayensis*) being brought in this year on July 22. The modern whaler will shoot at any whale over 40 feet in length.

After the whale is shot it is speedily hauled alongside the steamer, and the tail flukes cut off to facilitate towing to the station. A steel tube is next stuck into the abdomen and air pumped in to keep the whale afloat, the orifice being stuffed with oakum when the tube is withdrawn. The harpoon is left in the carcass until the whale arrives at the platform, where it is flensed, i.e. stripped of its blubber. The dead whales are invariably towed ashore to a whaling station for the extraction of the oil and treatment of the carcass.

After arrival at the station the whale is hauled up a slip on to a flensing platform by means of a powerful steam-winch. A Blue whale may weigh up to seventy tons, and is rightly considered a great catch. First, the valuable blubber is flensed off by a steam-winch, the flenser having made two or three longitudinal incisions down the whale's side to facilitate the removal of the blubber from the underlying flesh. The blubber is then cut up by a machine like a circular saw into small pieces, which are hoisted up into a gigantic boiler. From the blubber the best oil is obtained. The whale "bone" is now removed from the upper jaw and set aside for subsequent treatment. Now comes the turn of the Faroe islanders. The whaling company is compelled by the terms of its lease to sell to the islanders as much whale meat as they require at a fixed price of ten kroner (10s.) per small barrel, and the Faroe men crowd round eagerly to get such a

welcome addition to their winter stock of provender. This meat is salted down ; when fresh the meat of the Blue whale is like tender steak, but with a sweetish taste.

After the islanders have helped themselves, the flesh and bones are cut up into manageable sizes and treated in separate boilers, where a second-grade oil is extracted. After all the oil has been extracted, the residue of the bones and flesh is ground up and used for cattle meal and guano. Most of the oil is used for soap-making, but during the war it was sold to the

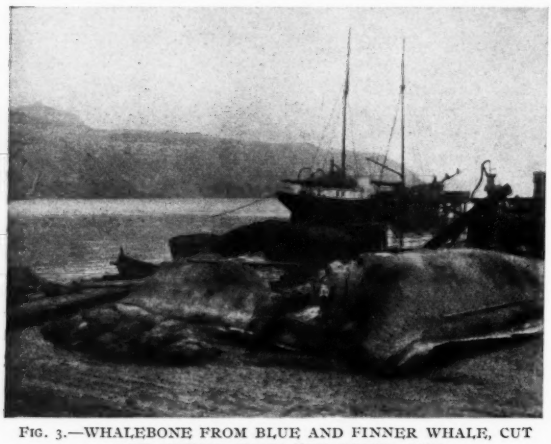


FIG. 3.—WHALEBONE FROM BLUE AND FINNER WHALE, CUT OUT ENTIRE FROM THE UPPER JAW.

The inner mat-like surface is seen.

manufacturers of explosives for extraction of glycerine. The lower grades are chiefly used for the manufacture of lubricating greases. The average yield of the three commoner species of finner is : Sei whale, ten barrels ; Common Finner, fifteen to seventy barrels ; Blue whale, fifty to seventy barrels.

The whalebone plates are separated, scrubbed, and soaked in warm soda solution, washed in warm water, and dried in the open air. When dry they are packed in sacks. The baleen from fin whales gives fourteen sacks to the ton. Most of the whalebone goes to Paris, where it is used in the form of fine threads woven into silken fabrics for stiffening purposes.

It is extremely difficult to convey an adequate idea of the enormous size of these creatures, but when you see six men exerting all their strength to turn over a relatively small portion of the whale's skull which has been cut off from the rest, you get some idea of their size and weight.

It is doubtful whether whaling will last very long under present conditions. There is general agreement that in the future whaling all over the world should be subjected to regulations for the protection of the few remaining cetacea. All the older " Fisheries "—the Basque fishery of the Bay of Biscay for the Nordcaper (*Balæna biscayensis*), the Greenland or Spitsbergen fishery for the Greenland Right whale (*Balæna mysticetus*), and the great Cachalot fisheries for the Sperm whale (*Physeter macrocephalus*)—came to an end through overfishing. In no case has there been a recovery of the species sufficient for a resumption of fishing, even after an unavoidable close time for over a century.

The great objection to whaling as at present carried on is that so many pregnant females or females with suckling young are killed ; theoretically, there is a prohibition against the killing of the latter in some areas, but there is no means by which a whaler can identify a gravid female while it is swimming in the water.

The whalers themselves say that the Finners will never become extinct, since whaling will automatically stop when it ceases to be profitable. Under normal conditions at present they stop when the whaling steamers get less than thirty whales each per season. The whalers estimate that they kill about one in every ten whales seen, and at first sight that seems reassuring. While it is true that the Common Finner and the Sei whale may be killed off with impunity for years to come, there is strong reason for advocating international protection for the rarer whales, such as the Sperm and the Nordcaper, either by an absolute prohibition of their slaughter for a term of years, or by strictly limiting the number which may be killed at any particular station.

The Teaching of English in England

A Note on the Report of the Departmental Committee appointed by the Board of Education to inquire into the Position of English in the Educational System of England.[1]

MR. FISHER has been singularly fortunate in the various Departmental Committees appointed to inquire into the positions respectively of Classics, History, Natural Science, Modern Languages, and English in the educational system of England. All the reports issued have been of far-reaching importance, but " The Teaching of English in England " is in some respects the most interesting of them all. Certainly it makes a wider appeal than any of the others since the subject concerns not only teachers of every subject in the curriculum of British Universities and schools of every grade, but also every English-speaking man and woman the world over. The Committee were

[1] Published by His Majesty's Stationery Office. Pp. xv + 394. Price 1*s.* 6*d.* net.

desired to advise how the study of English " may best be promoted . . . regard being had to (1) the requirements of a liberal education ; (2) the needs of business, the professions, and public services ; and (3) the relation of English to other studies." The reference is sufficiently broad, and they have interpreted it in the broadest possible way, so that the Report as a whole is in itself a tribute to their humane attitude towards learning and a genuine contribution to educational and social science. While it necessarily deals to a large extent with pedagogical matters, it never, even when most detailed in its investigations, becomes purely pedagogic, nor does it ever lose sight of the deeper significance of English studies for English people.

The Introduction at once strikes the right note, when it insists that " the inadequate conception of the teaching of English in this country is not a separate defect which can be separately remedied," but is due to " the failure to conceive the full meaning and possibilities of national education as a whole, and that failure, again, is due to a misunderstanding of the educational values to be found in the different regions of mental activity, and especially to an underestimate of the importance of the English language and literature." It is impossible within the limits of an article to reproduce the sound remarks made in the report on the subject of education in general and the need that it should " bear directly on life, and that no part of the process should be without a purpose intelligible to everyone concerned." But these introductory paragraphs are of immense interest and importance and deserve careful attention.

The Committee next note the fact that in many schools of all kinds and grades the teaching of English is often entrusted to ill-qualified members of the staff and regarded as being inferior in importance. Yet " education in English is, for all Englishmen, a matter of the most vital concern. . . . Until a child has acquired a certain command of the native language, no other educational development is even possible. . . . A lack of language is a lack of the means of communication and of thought itself. . . . If a child is not learning good English he is learning bad English, and probably bad habits of thought. . . . English is plainly no matter of inferior importance, nor even one among the other branches of education, but the one indispensable preliminary and foundation of all the rest." This particular aspect of English language teaching is discussed in various connections. It is, for example, pointed out that inability to put thought into words sets a boundary to thought, and that when a man's vocabulary is limited, he is also incapable of thinking clearly—whatever the subject of his thought. Secondly, " If the teaching of the language were properly and universally provided for, the difference between educated and uneducated speech, which at present causes so much prejudice and difficulty of intercourse on both sides, would gradually disappear." " An education fundamentally English would, we believe, at any rate bridge, if not close, this chasm of separation [between different social classes]. The English people might learn as a whole to regard their own language, first with respect, and then with a genuine feeling of pride and affection." Thirdly, " English " is " the principal method whereby education may achieve its ultimate aim of giving a wide outlook on life."

It is interesting and immensely encouraging in this connection to find in Chapter V (" The Needs of Business") that the forty prominent firms which answered the Committee's inquiries about " the importance they attached as business men to a training in English," agreed that the matter was " one of considerable moment from the standpoint of trade." No less encouraging was their vigorous denunciation of so-called " Commercial English " and " the implicit assumption . . . that British trade would be efficient and successful in proportion to the amount of intellect and imagination brought to bear upon it, and that the schools would best serve 'the needs of business' by developing to the utmost the intellect and imagination of those about to enter the business world."

From the standpoint of trade, therefore, there is no necessity to distinguish between " the requirements of a liberal education " and " the needs of business." Indeed, many of the replies to the questionnaire are explicit on this subject : " Wise guidance in reading we consider the best method to adopt in teaching English " ; or : " Most young people have few ideas because they do not read much " ; or : " We think that a great deal of time . . . would be far better used in the study of English literature in its broader aspects." The Science Masters' Association (to represent which the witnesses examined came from Cheltenham, Eton, and Harrow ; i.e. were speaking from experience of a different type of education) complained similarly that their work was seriously hampered by their pupils' inability to express themselves " in a reasonably adequate manner " either in speech or writing, or to " read English sentences with understanding, or at least with power to say exactly what they did not understand." " They considered that neglect of the mother-tongue led . . . to inhibition of the general power of thinking."

It is not possible here, though it would be well worth while, to summarise the recommendations made by the Committee with a view to the improvement of English teaching to children, adolescents, and adults in every kind of education. Two dicta may, however, be taken as typical of the wise spirit which inspires them all. The first concerns the Universities, and every competent University teacher will endorse what is said : " English, then, is needed in every Faculty. . . . Without it *the student* cannot attain to full powers either of learning or of teaching in any. We should like to see this officially recognised. We should like it to be officially proclaimed by each University that in all its examinations the quality of the English written or spoken by candidates, especially its lucidity and its fitness to the subject, will carry great weight with the examiners. . . . English is . . . an indispensable handmaid without whose assistance neither philosopher, nor chemist, nor classical scholar can do his work properly."

The second is the admirable account of the place of English in the curriculum of technical students, whether in Universities, technical colleges, or evening schools, i.e. whatever the age or intellectual development of the pupils. The Committee are of opinion that for such students

English, " even literature, can and should be given a vocational bias, can be made to bear directly upon the life and work of all those who study it, can, in short, be handled " (as, in fact, it is very rarely handled in British technical education) " as an actuality of vital interest and with an intelligible purpose to everyone concerned." The Report, as an example of what is intended, gives an account of the experiment carried out with engineering students by Professor Frank Aydelotte, of the Massachusetts Institute of Technology (vide pp. 161–4). But similar methods are possible and desirable with students of agriculture, of commerce, or of domestic subjects, and their introduction is of primary importance to education. Anyone who has come in contact with these students either socially or in the class-room will recognise the need for such training in the mother-tongue as will be " a training in thought, the influence of which is to clarify and humanise the student's character and his aims in life."

This humane education cannot be the result of linguistic training alone. The Committee's Report carefully discriminates between the teaching of English language and that of English literature, for, closely interrelated as they necessarily are, there is also a very definite cleavage between them. At its lowest, the use of English is necessary for utilitarian purposes; at its highest, accomplishment in the use of the English language is a fine art, the mastery of which, while all may learn to appreciate it, can be acquired only by the few. English literature also, as the Report is at pains to emphasise, has direct bearing upon life and is of universal importance, but as an art, " as a means of contact with great minds, a channel by which to draw upon their experience with profit and delight, and a bond of sympathy between the members of a human society."

For English-speaking people, English literature may provide a full measure of culture and humane training; it must, in their case, and whatever studies may be added to it, form the essential basis of a liberal education. This is not to belittle any other literature, classical or modern, (and on this point once more we refer the reader to the Report and what is there said on the subject of the classics, p. 18 and elsewhere), or training in any other subject (see p. 14). It is the statement of a fact.

The Report insists on the necessity of treating " literature, not as language merely, not as an ingenious set of symbols, a superficial and superfluous kind of decoration, or a graceful set of traditional gestures, but as the self-expression of great natures, the record and rekindling of spiritual experiences, and in daily life for every one of us the means by which we may, if we will, realise our own impressions and communicate them to our fellows." " The literature of England belongs to all England. . . and all may enjoy it who will."

The Committee do not ignore the fact that " there is another delight besides this open and universal one. In this matter, as in others, the scholar has his own task and his own reward." They discuss in as much detail the curriculum and aims of University " English " as those of every other type of teaching. Here, as elsewhere, they raise many controversial questions, and individual readers will have their own opinions about the solutions offered or the suggestions made. Already the discussion about English grammar has produced criticism from various quarters; much will no doubt be heard on the subject of University Schools of English, and so with regard to almost every important question as it affects the curriculum or methods at the various stages of instruction. But such discussion is in itself stimulating, and the Report would have served a useful purpose had its publication caused merely an awakening or renewal of interest in themes, a tithe of which we have perforce left untouched.

In this short note it has been possible to call attention only to the broader aspects of the Report and to the spirit by which it is animated. The writer is convinced that if it be widely read and its teachings taken to heart, it contains enough matter to produce a revolution not merely in the " teaching of English," but also in the national conception of what is implied by a liberal education.

EDITH J. MORLEY.

Reviews of Books

SOME BOOKS ON CHEMISTRY

(*a*) *Early Science in Oxford*. Part I—Chemistry. By R. T. GUNTHER, M.A. (H. Milford, 10*s*. 6*d*.)

(*b*) *An Introduction to Organic Chemistry*. By D. LL. HAMMICK, M.A., Fellow of Oriel College, Oxford. (G. Bell & Sons, 6*s*.)

(*c*) *Fuels and Refractory Materials*. By Prof. A. HUMBOLDT SEXTON, F.I.C., and W. B. DAVIDSON, D.Sc., Ph.D. (Blackie & Son, 12*s*. 6*d*.)

(*a*) The purpose of this volume is to interest the present generation in the early days of science in Oxford, and to this end Mr. Gunther, of Magdalen College, has collected together a great deal of interesting information concerning chemistry that hitherto has been largely scattered.

Roger Bacon, the earliest exponent of experimental science, and a great teacher, worked at Oxford in the thirteenth century. The Hon. Robert Boyle was at Christ Church, and had a laboratory in the High. He brought over from Holland one Peter Sthael, who has the distinction of being the first teacher of practical chemistry. Among Sthael's pupils were Wren, the church builder, " a prodigious young scholar," and John Locke, the philosopher. In the laboratory the latter apparently eschewed his philosophic calm, being " of turbulent spirit, clamorous and never contented," and refused to take any notes of the lectures; he was considered " prating and troublesome." Later, however, he wrote to Boyle concerning experimental chemistry, " I find my fingers still itch to be at it."

It is interesting to know that Oxford had a hand also in early industrial chemistry. John Dwight, of Christ Church, discovered the method of making salt-glazed stoneware in 1661, and some years earlier, Dr. John Wall, of Worcester and Merton Colleges, invented the process of manufacturing Worcester China.

The book is suitably illustrated, and has an appendix of photographs of the chemical apparatus of Dr. Daubeney, who became professor of chemistry in 1822.

(*b*) At the recent meeting of the British Association, Dr. M. O. Forster put forward a strong plea for more recognition of the fundamental importance of organic chemistry, and for the teaching of the subject at an earlier stage than is usually the case at present. For some reason organic chemistry seems to be regarded as an almost sacrosanct subject unfitted for the eyes and ears of youth, and not lightly to be entered upon until the pupil has already mastered the chief points of descriptive inorganic chemistry and the elements of physical chemistry.

Thus it comes about that organic chemistry—the most humane part of the science in that all vital processes and life itself are its special province—is left out of account in the early instruction of the budding chemist; and later, when he is at last introduced to it, he is likely either to be tired of chemistry, or so filled with facts and figures relating to the inorganic and physical branches that he has little interest for the organic branch.

Fortunately, Mr. Hammick has had much opportunity of studying the problem at first hand at Holt School and at Winchester, and, as he is at pains to point out, the book is written not with a view to covering any special syllabus, but in order to introduce to the beginner the idea of structure and to familiarise him with the elementary notation and technique of organic chemistry.

The author assumes, of course, that the reader has an acquaintance with elementary chemistry and with general laboratory operations. After introducing the subject and discussing the question of valency, structural formulæ, and methods of analysis, the book deals with the production and isolation of ethyl alcohol, thence it passes to other alcohols, and so to the discussion of homology, the essential facts of which are very clearly shown in the table on p. 26.

Interspersed in the text are suitable simple experiments which can be readily carried out in the laboratory.

Thence by easy stages the beginner is introduced to the subjects of esters and isomerism. Chapter IV is devoted to the action of sulphuric acid upon alcohol, leading to the formation of ether and ethylene, thus affording an opportunity for discussing saturation and unsaturation. After this the usual derivatives are dealt with, such as aldehydes, fatty acids, ketones, paraffins, amides, etc.; the latter half of the book deals with the aromatic compounds.

The book is essentially readable throughout, and it would be difficult for anyone who has worked carefully through the text and the experiments not to have had his interest and even his enthusiasm aroused for the wonders of organic chemistry. This may serve to carry him forward through the more tedious parts of the subject occasionally met with in the larger textbooks.

(*c*) Dr. Davidson has given Professor Humboldt Sexton's well-known work a thorough revision, and brought it, as far as possible, up-to-date. The earlier editions were found suitable for use as a textbook by students of technical chemistry, and by engineers with a limited training in general chemistry who required a book dealing with the chemistry, and particularly the physical chemistry, of the various kinds of fuels. To these and to students of inorganic chemistry generally this new edition should be of use and value. A. S. R.

AFRICAN EXPLORATION

(*a*) *A Naturalist on Lake Victoria.* By G. D. Hale Carpenter, M.B.E., D.M., B.Ch., etc. Illustrated. (T. Fisher Unwin, Ltd., 28*s*.)

(*b*) *Exploration of Air. Out of the World North of Nigeria.* By Angus Buchanan, M.C. Illustrated. (John Murray, 16*s*.)

(*a*) Since 1849, the year in which Livingstone discovered Lake Ngami, the vast continent of Africa has tempted many white men to explore and, in some cases, even to settle down in its inner sanctuaries. To those of us who watch from afar, the exploits and work of these pioneers possess a romantic interest quite apart from their results. The heart of Africa has been slowly revealed during the last seventy years. The history of the manner in which its mysteries have been wrested from it is to us as absorbingly interesting as the mysteries themselves, for it shows us the man of civilisation pitting his character against primitive races, against almost insuperable natural obstacles, against terrible climatic conditions and, despite many individual failures, registering a general, though gradual, success. A particularly romantic type in this connection is the one-man pioneer, the man who goes out into the "blue" without a companion except amongst natives, whom he has to dominate or keep friendly by exercising the full powers of his personality. In such characteristics both these books have a common interest, despite the different nature of their subjects.

Even in those regions that have come under the white man's civilisation, much remains to be solved. In this direction Dr. Hale Carpenter has performed splendid service of great benefit to humanity by his lonely and detailed study of the Tse-tse fly and the Trypanosome, that minute unicellular organism which the fly injects by its bite into the blood, thereby causing sleeping sickness. Most of his investigations, extending over a period of three years, just previous to the war, were undertaken on the uninhabited groups of islands in the north-west corner of Lake Victoria, for the Tropical Diseases Committee of the Royal Society.

There are many forms of Trypanosome, and several species of Tse-tse fly. Dr. Hale Carpenter gives an exhaustive, yet easily intelligible and fascinating, account of their activities. But his book provides a wealth of information on the Natural History of the region. Particularly interesting to us was the chapter on Mammals and on the small monkeys of the *Cercopithecus* species, which were of use in his investigations of sleeping sickness, as the malignant Trypanosomes produce the disease in this monkey. Their various gradations of shrieks compose quite a small language, which Dr. Hale Carpenter interprets. He found them the "most charm-

ing companions" during his exile. Another and long chapter on the coloration of insects, with numerous details about protective, warning, and mimetic colours, should prove most valuable to zoologists, as also the succeeding chapter on *Pseudacræa eurytus*, a most remarkable polymorphic butterfly. Of its various mimetic forms, together with model species of another butterfly, *Planema*, two beautifully coloured plates are given. The book also contains a large number of original photographic illustrations.

(*b*) Captain Angus Buchanan belongs more to the class of adventurers and explorers, and though his book abounds with descriptions of many new mammals, birds, and butterflies, its main interest lies in his account of the little-explored mountains of Aïr, that rise in massive, barren, isolated groups out of the level monotony of that part of the Sahara which borders on Northern Nigeria. The author's expedition was undertaken in 1920 in the interests of Lord Rothschild, and its object was to "link up the chain of zoological geography across that portion of Central Africa which lies between Algeria in Northern Africa and Nigeria in West Africa."

The heights of the various Aïr mountain groups range from 3,000 to 5,000 feet. The author found the central group, the Timia Mountains, the most beautiful and fertile, in particular the Timia Gorge, about three or four miles long, "through which the wide shallow river-bed winds . . . while the steep slopes of the majestic heights of Agolak and Timia mountains descend on either side to its very margin, leaving, in places, narrow little stretches of ground upon the banks, no wider than a mansion garden, which are irrigated by means of wells and cultivated by the natives to grow wheat and millet and maize, or bear thick groves of date palms." The northern ranges, to which the French authorities were far from wishing the author to proceed, as they could not guarantee his safety, are far more barren, more sparsely populated, and infested with robber bands, with one of which Captain Buchanan's party nearly came into collision.

The total population of Aïr consists of 5,000 Tuaregs. The account of this branch of an Arab-like Semitic race that has interested anthropologists a great deal in recent years makes one of the most interesting chapters in this book. Captain Buchanan found them "the strangest race I have ever come into contact with—independent, haughty, daring, unscrupulous, and lazy in leisure, yet fit to rank among the finest travellers and camel-riders in the world." The men are of a slim, wiry build, while the women, who do not usually reach more than five feet in height, grow to a moderate stoutness in middle-age. The men, and not the women, wear the *yashmak*, or face-covering, which, though it is a Moslem custom, Captain Buchanan considers has an eminently practical value as well in protecting the face against sun-glare and sand-storms.

E. L.

We regret that, owing to lack of space in this number, we are obliged to reserve, for inclusion in the March number, the considerable amount of correspondence that has reached us.

Books Received

(Books mentioned in this column may or may not be reviewed in this number, or in a later number.)

CLASSICAL LITERATURE

The Legacy of Greece. Edited by R. W. Livingstone. (Oxford: Clarendon Press, 7*s.* 6*d.*)

MISCELLANEOUS

The Calendar. Its History, Structure, and Improvement. By Alexander Philip, LL.B., F.R.S. (Cambridge University Press, 7*s.* 6*d.*)

The Beginning of the Year in the Middle Ages. By Reginald L. Poole. [From the *Proceedings of the British Academy*, vol. x.] (Published for the British Academy by Humphrey Milford, Oxford University Press, 3*s.* 6*d.*)

Up against it in Nigeria. By Langa-Langa. With 47 Illustrations. (London: George Allen & Unwin, Ltd., 18*s.*)

Oil. Its Influence on Politics. By Francis Delaisi. (The Labour Publishing Company, Ltd., and George Allen & Unwin, Ltd. Paper, 2*s* 6*d.*; cloth, 3*s.* 6*d.*)

PSYCHOLOGY AND PSYCHICAL RESEARCH

The Psycho-Analytic Study of the Family. By J. C. Flügel. (International Psycho-Analytical Press, and George Allen & Unwin, Ltd., 10*s.* 6*d.*) No. 3 of the International Psycho-Analytical Library, edited by Ernest Jones.

The Survival of the Soul and its Evolution after Death. Notes of Experiments by Pierre-Emille Cornillier. (Kegan Paul, Trench, Trubner & Co., Ltd., 10*s.* 6*d.*)

SCIENCE

Radiations from Slow Radium and their Therapeutic Value. By John B. Kramer. (Baillière, Tindall & Cox, 12*s.* 6*d.*)

Patents and Chemical Research. By H. E. Potts, B.Sc. (Liverpool University Press, 8*s.* 6*d.*)

Rays of Positive Electricity, and their Application to Chemical Analysis. 2nd Edition. By Sir J. J. Thomson, O.M., F.R.S. (Longmans, Green & Co., 16*s.*)

A Textbook of Geology. Vol. I, *General Geology.* Vol. II, *Historical Geology.* By Professor A. W. Grabou, S.B., S.M., S.D. (George G. Harrap & Co., 6*4s.*)

An Introduction to Applied Geography. By Alexander Stevens, M.A., B.Sc. (Blackie & Son, Ltd., 6*s.*)

Some Factors in Thermal Sanitation in the Tropics. By G. W. Grabham, M.A., F.G.S. [From the *Journal of Hygiene*, January 12, 1921.] (Cambridge: University Press.]

A Star Atlas and Telescopic Handbook. By Arthur P. Norton, B.A. (Edinburgh: Gall and Inglis, 10*s.* 6*d.*)

Astronomical Photography for Amateurs. By H. H. Waters. (Edinburgh: Gall & Inglis, 6*s.*)